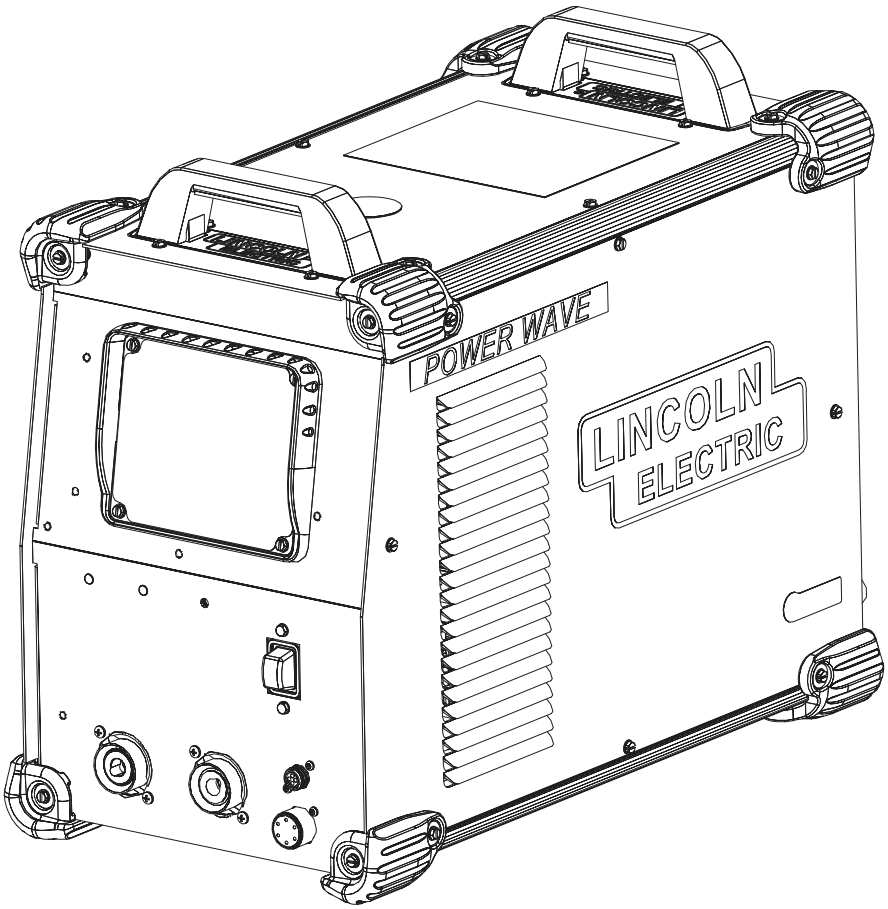
Return to Master TOC
View Safety Info
Return to Master TOC
View Safety Info
Return to Master TOC
View Safety Info
Return to Master TOC
View Safety Info

RETURN TO MAIN MENU

SVM203-A
October, 2010

POWER WAVE® S350

For use with machine code number: **11589**



Safety Depends on You

Lincoln arc welding and cutting equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation . . . and thoughtful operation on your part. **DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT.** And, most importantly, think before you act and be careful.

SERVICE MANUAL

Copyright © Lincoln Global Inc.

LINCOLN® ELECTRIC

• World's Leader in Welding and Cutting Products •
• Sales and Service through Subsidiaries and Distributors Worldwide •
Cleveland, Ohio 44117-1199 U.S.A. TEL: 1.888.935.3877 FAX: 216.486.1751 WEB SITE: www.lincolnelectric.com

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

⚠ WARNING

⚠ CALIFORNIA PROPOSITION 65 WARNINGS ⚠

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

The Above For Diesel Engines

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

The Above For Gasoline Engines

ARC WELDING can be hazardous. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2-1974. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.

FOR ENGINE powered equipment.

1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.

1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.

1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.

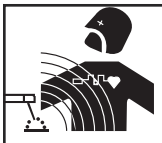
1.d. Keep all equipment safety guards, covers and devices in position and in good repair.Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.

1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.

1.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.

1.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.



ELECTRIC AND MAGNETIC FIELDS may be dangerous

2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines

2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.

2.c. Exposure to EMF fields in welding may have other health effects which are now not known.

2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:

2.d.1. Route the electrode and work cables together - Secure them with tape when possible.

2.d.2. Never coil the electrode lead around your body.

2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.

2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.

2.d.5. Do not work next to welding power source.

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

ELECTRIC SHOCK can kill.

3.a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- **Semiautomatic DC Constant Voltage (Wire) Welder.**
- **DC Manual (Stick) Welder.**
- **AC Welder with Reduced Voltage Control.**

3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically "hot".

3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.

3.e. Ground the work or metal to be welded to a good electrical (earth) ground.

3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.

3.g. Never dip the electrode in water for cooling.

3.h. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.

3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.

3.j. Also see Items 6.c. and 8.

ARC RAYS can burn.

4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87. I standards.

4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.

4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases.When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**

5. b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.

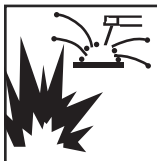
5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

5.e. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer's safety practices. MSDS forms are available from your welding distributor or from the manufacturer.

5.f. Also see item 1.b.

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC



WELDING and CUTTING SPARKS can cause fire or explosion.

6.a. Remove fire hazards from the welding area.If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to “Safety in Welding and Cutting” (ANSI Standard Z49.1) and the operating information for the equipment being used.

6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been “cleaned”. For information, purchase “Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances”, AWS F4.1 from the American Welding Society (see address above).

6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.

6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.

6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

6.h. Also see item 1.c.

6.I. Read and follow NFPA 51B “ Standard for Fire Prevention During Welding, Cutting and Other Hot Work”, available from NFPA, 1 Batterymarch Park,PO box 9101, Quincy, Ma 022690-9101.

6.j. Do not use a welding power source for pipe thawing.

CYLINDER may explode if damaged.

7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

7.c. Cylinders should be located:

- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.

7.d. Never allow the electrode, electrode holder or any other electrically “hot” parts to touch a cylinder.

7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-I, “Precautions for Safe Handling of Compressed Gases in Cylinders,” available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.

FOR ELECTRICALLY powered equipment.

8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.

8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer’s recommendations.

8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer’s recommendations.

Refer to **http://www.lincolnelectric.com/safety** for additional safety information.

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

PRÉCAUTIONS DE SÛRETÉ

Pour votre propre protection lire et observer toutes les instructions et les précautions de sûreté specifiques qui parraissent dans ce manuel aussi bien que les précautions de sûreté générales suivantes:

Sûreté Pour Soudage A L'Arc

1. Protegez-vous contre la secousse électrique:

   a. Les circuits à l'électrode et à la piéce sont sous tension quand la machine à souder est en marche. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vétements mouillés. Porter des gants secs et sans trous pour isoler les mains.
   b. Faire trés attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher metallique ou des grilles metalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
   c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état defonctionnement.
   d.Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
   e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
   f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces precautions pour le porte-électrode s'applicuent aussi au pistolet de soudage.

2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas ou on recoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.

3. Un coup d'arc peut être plus sévère qu'un coup de soliel, donc:

   a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
   b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
   c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.

4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.

5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans lateraux dans les zones où l'on pique le laitier.

6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû aux étincelles.

7. Quand on ne soude pas, poser la pince à une endroit isolé de la masse. Un court-circuit accidental peut provoquer un échauffement et un risque d'incendie.

8. S'assurer que la masse est connectée le plus prés possible de la zone de travail qu'il est pratique de le faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaines de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'echauffement des chaines et des câbles jusqu'à ce qu'ils se rompent.

9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particuliérement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumeés toxiques.

10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou pistolage. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgéne (gas fortement toxique) ou autres produits irritants.

11. Pour obtenir de plus amples renseignements sur la sûreté, voir le code "Code for safety in welding and cutting" CSA Standard W 117.2-1974.

PRÉCAUTIONS DE SÛRETÉ POUR LES MACHINES À SOUDER À TRANSFORMATEUR ET À REDRESSEUR

1. Relier à la terre le chassis du poste conformement au code de l'électricité et aux recommendations du fabricant. Le dispositif de montage ou la piece à souder doit être branché à une bonne mise à la terre.

2. Autant que possible, l'installation et l'entretien du poste seront effectués par un électricien qualifié.

3. Avant de faires des travaux à l'interieur de poste, la debrancher à l'interrupteur à la boite de fusibles.

4. Garder tous les couvercles et dispositifs de sûreté à leur place.

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

Electromagnetic Compatibility (EMC)

Conformance
Products displaying the CE mark are in conformity with European Community Council Directive of 15 Dec 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility, 2004/108/EC. It was manufactured in conformity with a national standard that implements a harmonized standard: EN 60974-10 Electromagnetic Compatibility (EMC) Product Standard for Arc Welding Equipment. It is for use with other Lincoln Electric equipment. It is designed for industrial and professional use.

Introduction
All electrical equipment generates small amounts of electromagnetic emission. Electrical emission may be transmitted through power lines or radiated through space, similar to a radio transmitter. When emissions are received by other equipment, electrical interference may result. Electrical emissions may affect many kinds of electrical equipment; other nearby welding equipment, radio and TV reception, numerical controlled machines, telephone systems, computers, etc. Be aware that interference may result and extra precautions may be required when a welding power source is used in a domestic establishment.

Installation and Use
The user is responsible for installing and using the welding equipment according to the manufacturer's instructions. If electromagnetic disturbances are detected then it shall be the responsibility of the user of the welding equipment to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing (grounding) the welding circuit, see Note. In other cases it could involve construction of an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

Note: The welding circuit may or may not be earthed for safety reasons according to national codes. Changing the earthing arrangements should only be authorized by a person who is competent to access whether the changes will increase the risk of injury, e.g., by allowing parallel welding current return paths which may damage the earth circuits of other equipment.

Assessment of Area
Before installing welding equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

a) other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the welding equipment;

b) radio and television transmitters and receivers;

c) computer and other control equipment;

d) safety critical equipment, e.g., guarding of industrial equipment;

e) the health of the people around, e.g., the use of pacemakers and hearing aids;

f) equipment used for calibration or measurement

g) the immunity of other equipment in the environment. The user shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures;

h) the time of day that welding or other activities are to be carried out.

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

Electromagnetic Compatibility (EMC)

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

Methods of Reducing Emissions

Mains Supply
Welding equipment should be connected to the mains supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the mains supply. Consideration should be given to shielding the supply cable of permanently installed welding equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the welding power source so that good electrical contact is maintained between the conduit and the welding power source enclosure.

Maintenance of the Welding Equipment
The welding equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the welding equipment is in operation. The welding equipment should not be modified in any way except for those changes and adjustments covered in the manufacturers instructions. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

Welding Cables
The welding cables should be kept as short as possible and should be positioned close together, running at or close to floor level.

Equipotential Bonding
Bonding of all metallic components in the welding installation and adjacent to it should be considered. However, metallic components bonded to the work piece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

Earthing of the Workpiece
Where the workpiece is not bonded to earth for electrical safety, not connected to earth because of its size and position, e.g., ships hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

Screening and Shielding
Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire welding installation may be considered for special applications. [1]

---

[1] Portions of the preceding text are contained in EN 60974-10: "Electromagnetic Compatibility (EMC) product standard for arc welding equipment."

- MASTER TABLE OF CONTENTS FOR ALL SECTIONS -

RETURN TO MAIN MENU

Page

Safety . . . . . i-vi

Installation . . . . . Section A

Operation . . . . . Section B

Accessories . . . . . Section C

Maintenance . . . . . Section D

Theory of Operation . . . . . Section E

Troubleshooting and Repair . . . . . Section F

Electrical Diagrams . . . . . Section G

Parts Manual P-609

TABLE OF CONTENTS - INSTALLATION SECTION

Installation **A-1**

Technical Specifications A-2

Safety Precautions A-4

Location, Lifting A-4

Stacking A-4

Tilting A-4

Input and Ground Connections A-4

Machine Grounding A-4

High Frequency Protection A-4

Input Connection A-5

Input Fuse and Supply Wire A-5

Input Voltage Selection A-5

Power Cord Replacement A-5

Connection Diagram A-6

Recommended Work Cable Sizes A-8

Cable Inductance and its Effects on Welding A-9

Remote Sense Lead Specifications A-9

Voltage Sensing Considerations for Multiple Arc Systems A-11

Control Cable Connections A-13

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

TECHNICAL SPECIFICATIONS - POWER WAVE® S350

POWER SOURCE-INPUT VOLTAGE AND CURRENT

Model	Duty Cycle	Input Voltage ± 10%	Input Amperes (1 Phase in parenthesis)	Idle Power	Power Factor @ Rated Output
K2823-1	40% rating	200-208/230/380-415/460/575 50/60 Hz	39/35/20/17/14 (NA/65***/37/32/25)	300 Watts Max. (fan on)	.95
	100% rating		30/28/16/14/11 (56/51/29/25/20)		

RATED OUTPUT

INPUT VOLTAGE / PHASE / FREQUENCY	GMAW			SMAW			GTAW-DC		
	40%***	60%	100%	40%***	60%	100%	40%	60%	100%
200-208/1/50/60	300 Amps / 29 Volts			250 Amps / 30 Volts					
230/1/50/60 380-415/1/50/60 460/1/50/60 575/1/50/60 200-208/3/50/60 230/3/50/60 380-415/3/50/60 460/3/50/60 575/3/50/60	350 Amps 31.5 Volts	320 Amps 30 Volts	300 Amps 29 Volts	325 Amps 33 Volts	275 Amps 31 Volts	250 Amps 30 Volts	350 Amps 24 Volts	325 Amps 23Volts	300 Amps 22 Volts

*** On 230 Volt / 1 phase inputs the max. rating is at a duty cycle of 30%, except for GTAW processes.

RECOMMENDED INPUT WIRE AND FUSE SIZES [1]

INPUT VOLTAGE / PHASE/ FREQUENCY	MAXIMUM INPUT AMPERE RATING AND DUTY CYCLE	CORD SIZE [3] AWG SIZES (mm^2)	TIME DELAY FUSE OR BREAKER [2] AMPERAGE	NOTES
200-208/1/50/60	60A, 100%	6 (13)	80	NOTE 4
200-208/3/50/60	39A, 40%	8 (10)	50	
230/1/50/60	67A, 30%	4 (16)	80	NOTE 4
230/3/50/60	35A, 40%	8 (10)	45	
380-415/1/50/60	38A, 40%	8 (10)	50	
380-415/3/50/60	19A, 40%	12 (4)	30	
460/1/50/60	34A, 40%	8 (10)	45	
460/3/50/60	17A, 40%	12 (4)	25	
575/1/50/60	27A, 40%	10 (6)	35	
575/3/50/60	14A, 40%	14 (2.5)	20	

1. Based on U.S. National electrical Code
2. Also called " inverse time" or "thermal / magnetic" circuit breakers; circuit breakers that have a delay in tripping action that decreases as the magnitude of the current increases
3. Type SO cord or similar in 30° C ambient
4. When operating on these inputs, the line cord should be changed to an input conductor of 6 AWG or larger.

Return to Section TOC
Return to Master TOC

WELDING PROCESS			
PROCESS	OUTPUT RANGE (AMPERES)	OCV (U_o)	
		Mean	Peak
GMAW GMAW-Pulse FCAW GTAW-DC SMAW	5-350	40-70 40-70 40-70 24 60	100V

PHYSICAL DIMENSIONS				
MODEL	HEIGHT	WIDTH	DEPTH	WEIGHT
K2823-1	20.40 in (518 mm)	14.00in (356 mm)	24.80in (630mm)	85 lbs (39 kg)*

TEMPERATURE RANGES	
OPERATING TEMPERATURE RANGE	**STORAGE TEMPERATURE RANGE**
Environmentally Hardened: -4°F to 104°F (-20C to 40C)	Environmentally Hardened: -40°F to 185°F (-40C to 85C)

IP23 155°(F) Insulation Class

* Weight does not include input cord.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

SAFETY PRECAUTIONS

Read this entire installation section before you start installation.

WARNING

ELECTRIC SHOCK can kill.

- **Only qualified personnel should perform this installation.**
- **Turn the input power OFF at the disconnect switch or fuse box before working on this equipment. Turn off the input power to any other equipment connected to the welding system at the disconnect switch or fuse box before working on the equipment.**
- **Do not touch electrically hot parts.**
- **Always connect the POWER WAVE® S350 grounding lug to a proper safety (Earth) ground.**

SELECT SUITABLE LOCATION

The POWER WAVE® S350 will operate in harsh environments. Even so, it is important that simple preventative measures are followed in order to assure long life and reliable operation.

- The machine must be located where there is free circulation of clean air such that air movement in the back, out the sides and bottom will not be restricted.
- Dirt and dust that can be drawn into the machine should be kept to a minimum. The use of air filters on the air intake is not recommended because normal air flow may be restricted. Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdown.
- Keep machine dry. Shelter from rain and snow. Do not place on wet ground or in puddles.
- Do not mount the POWER WAVE® S350 over combustible surfaces. Where there is a combustible surface directly under stationary or fixed electrical equipment, that surface shall be covered with a steel plate at least .060" (1.6mm) thick, which shall extend not less than 5.90" (150mm) beyond the equipment on all sides.

LIFTING

Both handles should be used when lifting POWER WAVE® S350. When using a crane or overhead device a lifting strap should be connected to both handles. Do not attempt to lift the POWER WAVE® S350 with accessories attached to it.

WARNING

- **Lift only with equipment of adequate lifting capacity.**
- **Be sure machine is stable when lifting.**
- **Do not operate machine while suspended when lifting.**

FALLING EQUIPMENT can cause injury.

STACKING

The POWER WAVE® S350 cannot be stacked.

TILTING

Place the machine directly on a secure, level surface or on a recommended undercarriage. The machine may topple over if this procedure is not followed.

INPUT AND GROUND CONNECTIONS

Only a qualified electrician should connect the POWER WAVE® S350. Installation should be made in accordance with the appropriate National Electrical Code, all local codes and the information in this manual.

MACHINE GROUNDING

The frame of the welder must be grounded. A ground terminal marked with a ground symbol is located next to the input power connection block.

See your local and national electrical codes for proper grounding methods.

HIGH FREQUENCY PROTECTION

The EMC classification of the POWER WAVE® S350 is Industrial, Scientific and Medical (ISM) group 2, class A. The POWER WAVE® S350 is for industrial use only. (See print L10093 for further details).

Locate the POWER WAVE® S350 away from radio controlled machinery. The normal operation of the POWER WAVE® S350 may adversely affect the operation of RF controlled equipment, which may result in bodily injury or damage to the equipment.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

INPUT CONNECTION

⚠ WARNING

Only a qualified electrician should connect the input leads to the POWER WAVE® S350. Connections should be made in accordance with all local and national electrical codes and the connection diagrams. Failure to do so may result in bodily injury or death.

A 10 ft. (3.0m) power cord is provided and wired into the machine.

For Single Phase Input

Connect green lead to ground per National Electrical Code.

Connect black and white leads to power.

Wrap red lead with tape to provide 600V insulation.

For Three Phase Input

Connect green lead to ground per National Electric Code.

Connect black, red and white leads to power.

INPUT FUSE AND SUPPLY WIRE CONSIDERATIONS

Refer to Specification Section for recommended fuse, wire sizes and type of the copper wires. Fuse the input circuit with the recommended super lag fuse or delay type breakers (also called "inverse time" or "thermal/magnetic" circuit breakers). Choose input and grounding wire size according to local or national electrical codes. Using input wire sizes, fuses or circuit breakers smaller than recommended may result in "nuisance" shut-offs from welder inrush currents, even if the machine is not being used at high currents.

INPUT VOLTAGE SELECTION

The POWER WAVE® S350 automatically adjusts to work with different input voltages. No reconnect switches settings are required.

⚠ WARNING

The POWER WAVE® S350 ON/OFF switch is not intended as a service disconnect for this equipment. Only a qualified electrician should connect the input leads to the POWER WAVE® S350. Connections should be made in accordance with all local and national electrical codes and the connection diagram located on the inside of the reconnect access door of the machine. Failure to do so may result in bodily injury or death.

POWER CORD REPLACEMENT

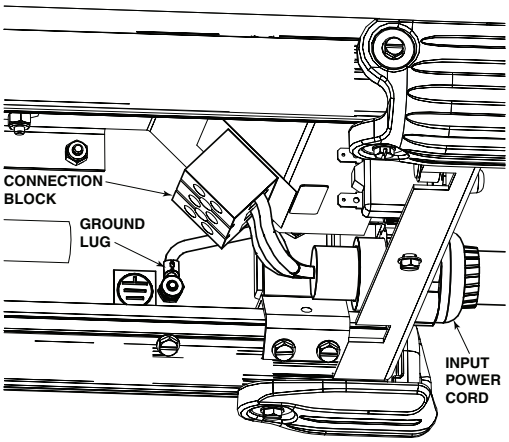
⚠ WARNING

Only a qualified electrician should connect the input leads to the POWER WAVE® S350. Connections should be made in accordance with all local and national electrical codes and the connection diagrams. Failure to do so may result in bodily injury or death.

If the **input power cord** is damaged or needs to be replaced an input power **connection block** is located in the back of the machine with the access panel removed as shown Figure A.1.

ALWAYS CONNECT THE POWER WAVE **GROUNDING LUG** (LOCATED AS SHOWN IN FIGURE A.1) TO A PROPER SAFETY (EARTH) GROUND.

FIGURE A.1



CONNECTION DIAGRAMS

GTAW (TIG) WELDING

A user interface is required for adjusting the TIG welding settings. A Power Feed wire feeder can be used as the user interface (Figure A.2), or a S-series user interface (K2828-1) can be installed into the power source (Figure A.3). Refer to the connection diagrams based on the user interface that is being used. For either set-up the K2825-1 solenoid kit is recommended for controlling the gas. Alternate configurations are possible depending on the wire feeder that is being used. Refer to the wire feeder's manual for alternative configurations.

SMAW (STICK) WELDING

Similar to TIG welding a user interface is required for adjusting the Stick welding settings. A Power Feed wire feeder can be used as the user interface, or a K2828-1 (user interface control panel) can be installed into the power source ***(Figure A.4)***. The connection diagram shown is based on the S-Series user interface (K2828-1). In this diagram the remote control box is optional.

GMAW (MIG) WELDING

An arclink compatible wire feeder is recommended for Mig welding. Refer to ***Figure A.5*** for the connection details.

FIGURE A.2

TIG WITH POWER FEED USER INTERFACE

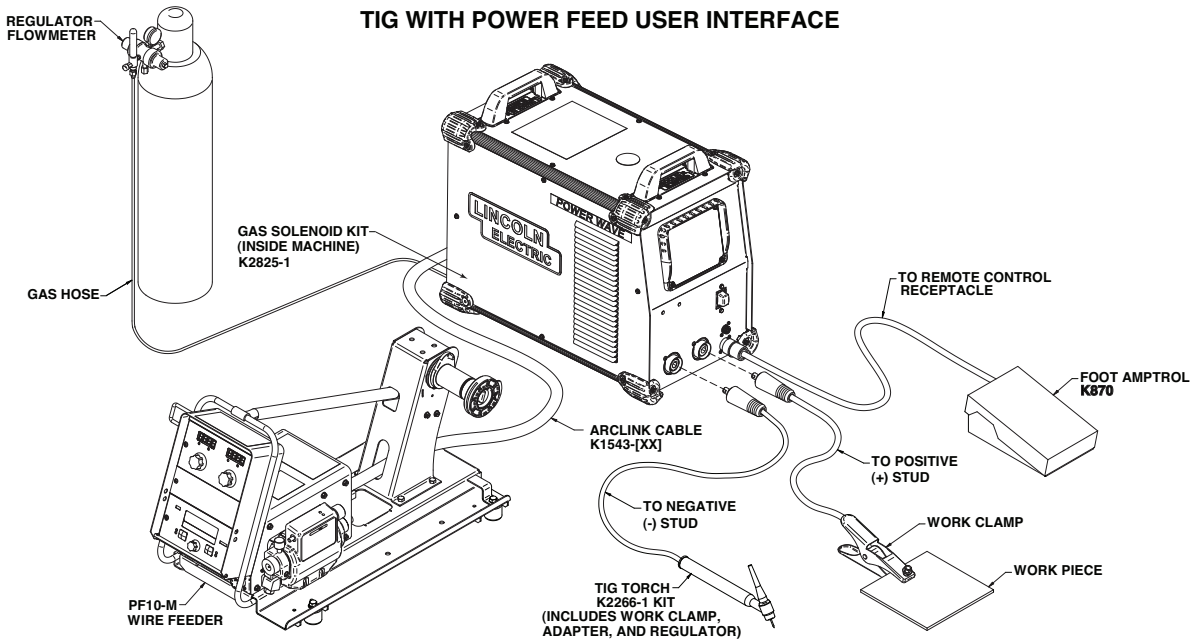
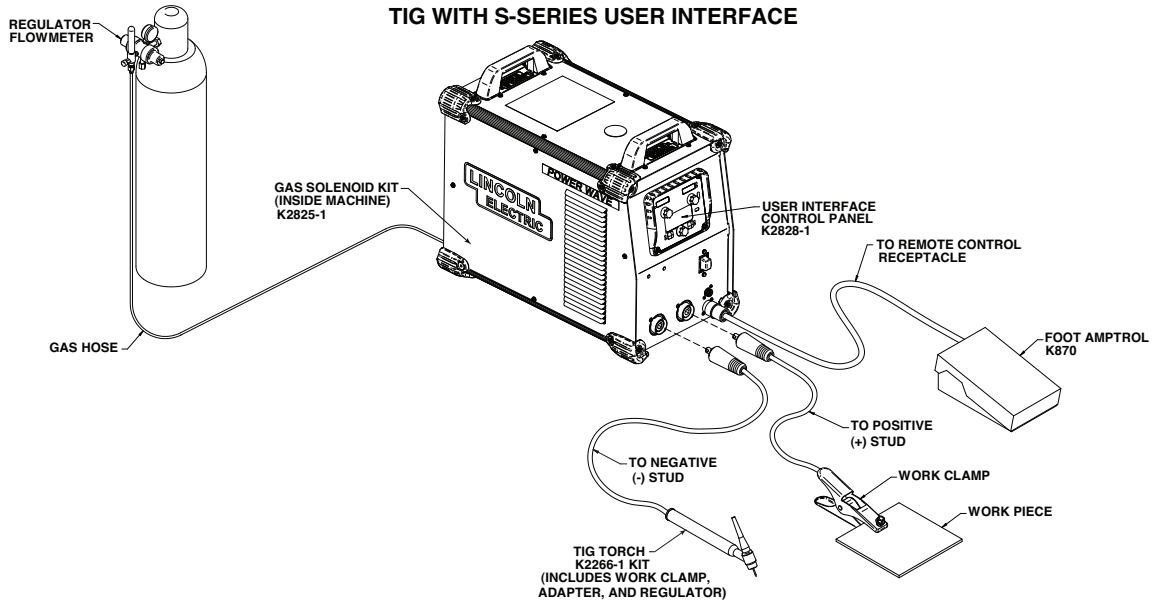


FIGURE A.3

TIG WITH S-SERIES USER INTERFACE



Return to Section TOC
Return to Master TOC

FIGURE A.4 - STICK WITH S-SERIES USER INTERFACE

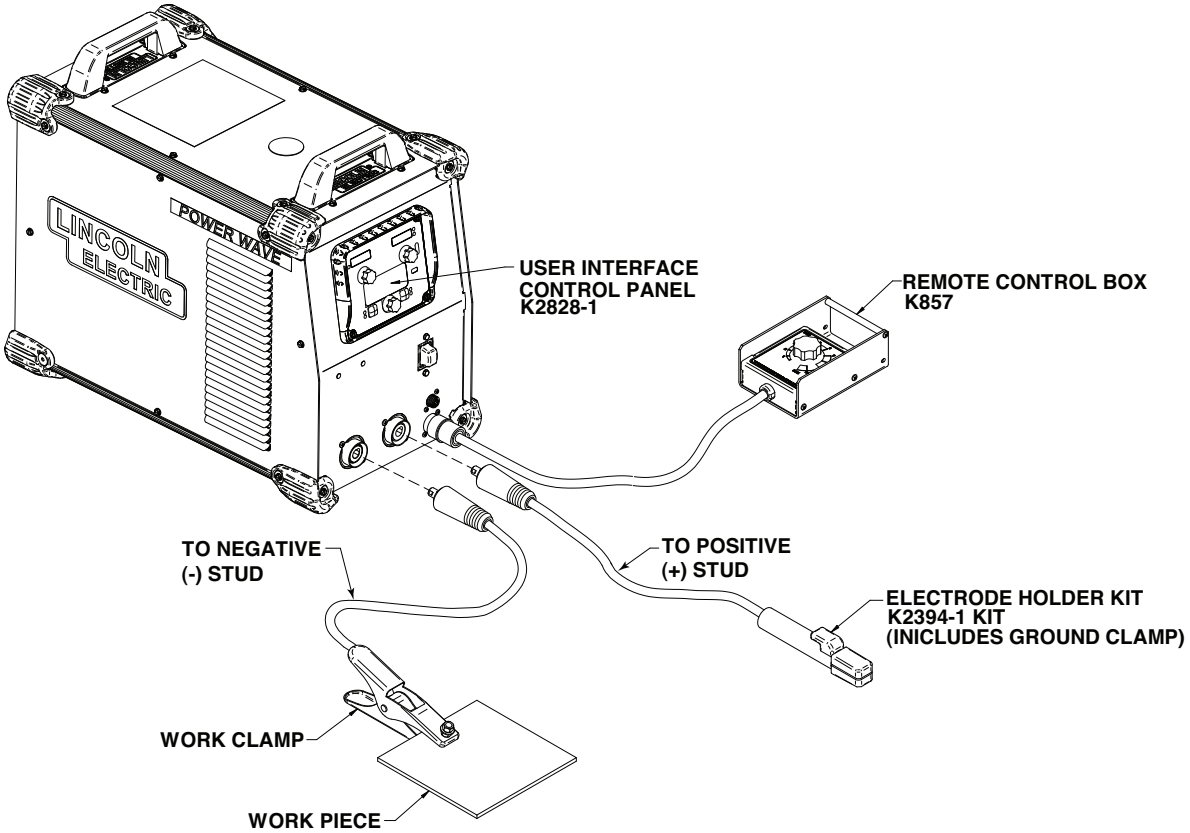
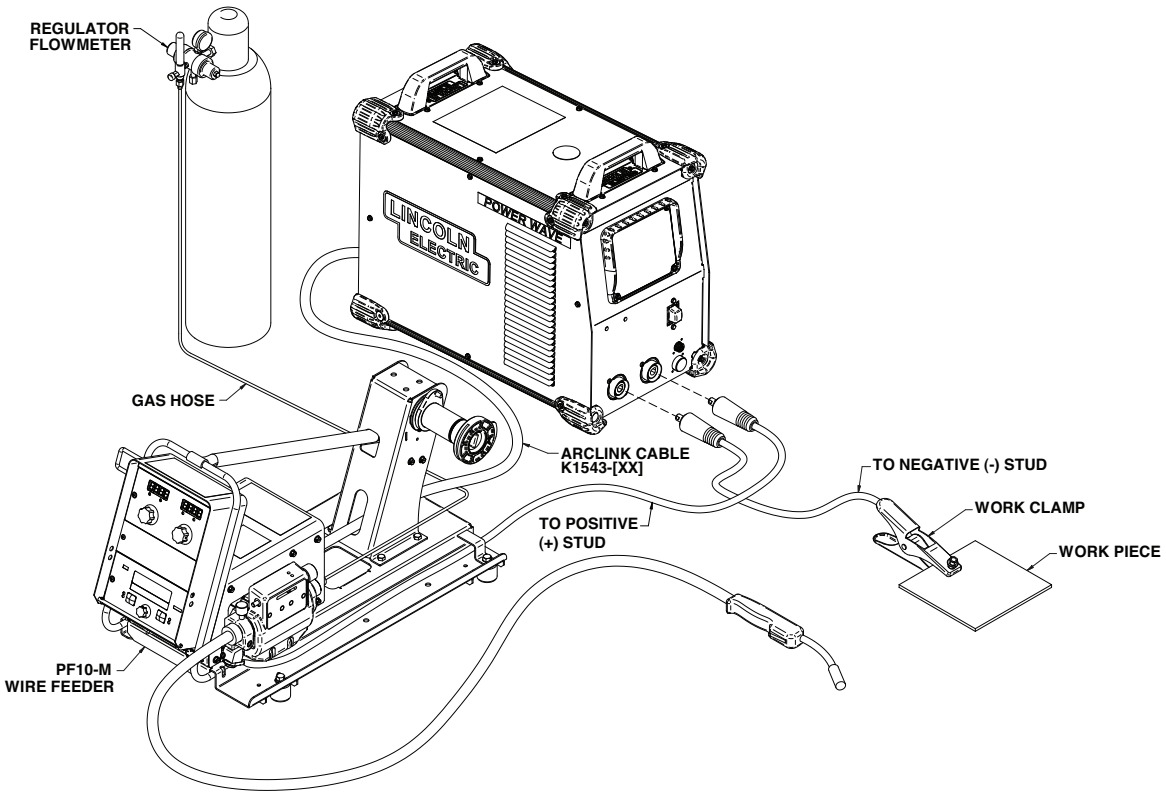


FIGURE A.5 - MIG PROCESS



Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

RECOMMENDED WORK CABLE SIZES FOR ARC WELDING

Connect the electrode and work cables between the appropriate output studs of the Power Wave S350 per the following guidelines:

- Most welding applications run with the electrode being positive (+). For those applications, connect the electrode cable between the wire drive feed plate and the positive (+) output stud on the power source. Connect a work lead from the negative (-) power source output stud to the work piece
- When negative electrode polarity is required, such as in some Innershield applications, reverse the output connections at the power source (electrode cable to the negative (-) stud, and work cable to the positive (+) stud).

⚠ CAUTION

Negative electrode polarity operation WITHOUT use of a remote work sense lead (21) requires the Negative Electrode Polarity attribute to be set. See the Remote Sense Lead Specification section of this document for further details.

For additional Safety information regarding the electrode and work cable set-up, See the standard "SAFETY INFORMATION" located in the front of the Instruction Manuals.

GENERAL GUIDELINES

- Select the appropriate size cables per the "Output Cable Guidelines" below. Excessive voltage drops caused by undersized welding cables and poor connections often result in unsatisfactory welding performance. Always use the largest welding cables (electrode and work) that are practical, and be sure all connections are clean and tight.

Note: Excessive heat in the weld circuit indicates undersized cables and/or bad connections.

- Route all cables directly to the work and wire feeder, avoid excessive lengths and do not coil excess cable. Route the electrode and work cables in close proximity to one another to minimize the loop area and therefore the inductance of the weld circuit.

- Always weld in a direction away from the work (ground) connection.

Table A.1 shows copper cable sizes recommended for different currents and duty cycles. Lengths stipulated are the distance from the welder to work and back to the welder again. Cable sizes are increased for greater lengths primarily for the purpose of minimizing cable drop.

TABLE A.1

OUTPUT CABLE GUIDELINES

Amperes	Percent Duty Cycle	CABLE SIZES FOR COMBINED LENGTHS OF ELECTRODE AND WORK CABLES [RUBBER COVERED COPPER - RATED 167°F (75°C)]**				
		0 to 50 Ft.	50 to 100 Ft.	100 to 150 Ft.	150 to 200 Ft.	200 to 250 Ft.
200	60	2	2	2	1	1/0
200	100	2	2	2	1	1/0
250	30	3	3	2	1	1/0
250	40	2	2	1	1	1/0
250	60	1	1	1	1	1/0
250	100	1	1	1	1	1/0
300	60	1	1	1	1/0	2/0
300	100	2/0	2/0	2/0	2/0	3/0
350	40	1/0	1/0	2/0	2/0	3/0

** Tabled values are for operation at ambient temperatures of 104°F (40°C) and below. Applications above 104°F (40°C) may require cables larger than recommended, or cables rated higher than 167°F (75°C).

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CABLE INDUCTANCE AND ITS EFFECTS ON WELDING

Excessive cable inductance will cause the welding performance to degrade. There are several factors that contribute to the overall inductance of the cabling system including cable size, and loop area. The loop area is defined by the separation distance between the electrode and work cables, and the overall welding loop length. The welding loop length is defined as the total of length of the electrode cable (A) + work cable (B) + work path (C) (See Figure A.6).

To minimize inductance always use the appropriate size cables, and whenever possible, run the electrode and work cables in close proximity to one another to minimize the loop area. Since the most significant factor in cable inductance is the welding loop length, avoid excessive lengths and do not coil excess cable. For long work piece lengths, a sliding ground should be considered to keep the total welding loop length as short as possible.

REMOTE SENSE LEAD SPECIFICATIONS

Voltage Sensing Overview

The best arc performance occurs when the Power Wave S350 has accurate data about the arc conditions. Depending upon the process, inductance within the electrode and work cables can influence the voltage apparent at the studs of the welder, and have a dramatic effect on performance. Remote voltage sense leads are used to improve the accuracy of the arc voltage information supplied to the control pc board. Sense Lead Kits (K940-xx) are available for this purpose.

The Power Wave S350 has the ability to automatically sense when remote sense leads are connected. With this feature there are no requirements for setting-up the machine to use remote sense leads. This feature can be disabled through the Weld Manager Utility (available at www.powerwavesoftware.com) or through the set up menu (if a user interface is installed into the power source).

⚠ CAUTION

If the auto sense lead feature is disabled and remote voltage sensing is enabled but the sense leads are missing or improperly connected, extremely high welding outputs may occur.

General Guidelines for Voltage Sense Leads

Sense leads should be attached as close to the weld as practical, and out of the weld current path when possible. In extremely sensitive applications it may be necessary to route cables that contain the sense leads away from the electrode and work welding cables.

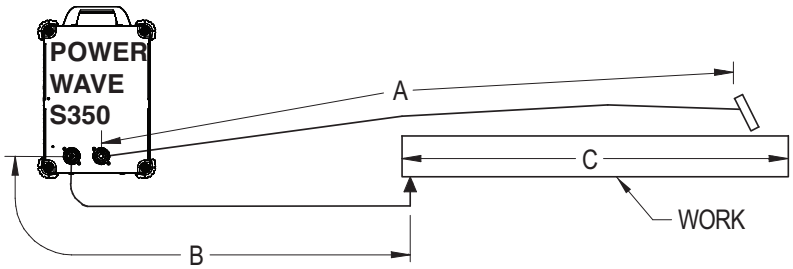
Voltage sense leads requirements are based on the weld process (See Table A.2)

TABLE A.2

Process	Electrode Voltage Sensing (1) 67 lead	Work Voltage Sensing (2) 21 lead
GMAW	67 lead required	21 lead optional
GMAW-P	67 lead required	21 lead optional
FCAW	67 lead required	21 lead optional
GTAW	Voltage sense at studs	Voltage sense at studs
SMAW	Voltage sense at studs	Voltage sense at studs

(1) The electrode voltage sense lead (67) is automatically enabled by the weld process, and integral to the 5 pin arclink control cable (K1543-xx).
(2) When a work voltage sense lead (21) is connected the power source will automatically switch over to using this feedback (if the auto sense feature is enable).

FIGURE A.6



Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Electrode Voltage Sensing

The remote ELECTRODE sense lead (67) is built into the 5-pin arclink control cable (K1543-xx) and is always connected to the wire drive feed plate when a wire feeder is present. Enabling or disabling electrode voltage sensing is application specific, and automatically configured by the active weld mode.

Work Voltage Sensing

The Power Wave S350 is configured at the factory to sense work voltage at the negative output stud (positive output polarity with remote Work Voltage Sensing disabled).

Negative Electrode Polarity

The Power Wave S350 has the ability to automatically sense the polarity of the sense leads. With this feature there are no set-up requirements for welding with negative electrode polarity. This feature can be disabled through the Weld Manager Utility (available at www.powerwavesoftware.com) or through the set up menu (if a user interface is installed into the power source).

⚠ CAUTION

If the auto sense lead feature is disabled and the weld polarity attribute is improperly configured extremely high welding outputs may occur.

While most applications perform adequately by sensing the work voltage directly at the output stud, the use of a remote work voltage sense lead is recommended for optimal performance. The remote WORK sense lead (21) can be accessed through the four-pin voltage sense connector located on the control panel by using the K940 Sense Lead Kit. It must be attached to the work as close to the weld as practical, but out of the weld current path. For more information regarding the placement of remote work voltage sense leads, see the section entitled "***Voltage Sensing Considerations for Multiple Arc Systems.***"

VOLTAGE SENSING CONSIDERATIONS FOR MULTIPLE ARC SYSTEMS

Special care must be taken when more than one arc is welding simultaneously on a single part. Multiple arc applications do not necessarily dictate the use of remote work voltage sense leads, but they are strongly recommended.

If Sense Leads ARE NOT Used:

- Avoid common current paths. Current from adjacent arcs can induce voltage into each others current paths that can be misinterpreted by the power sources, and result in arc interference.

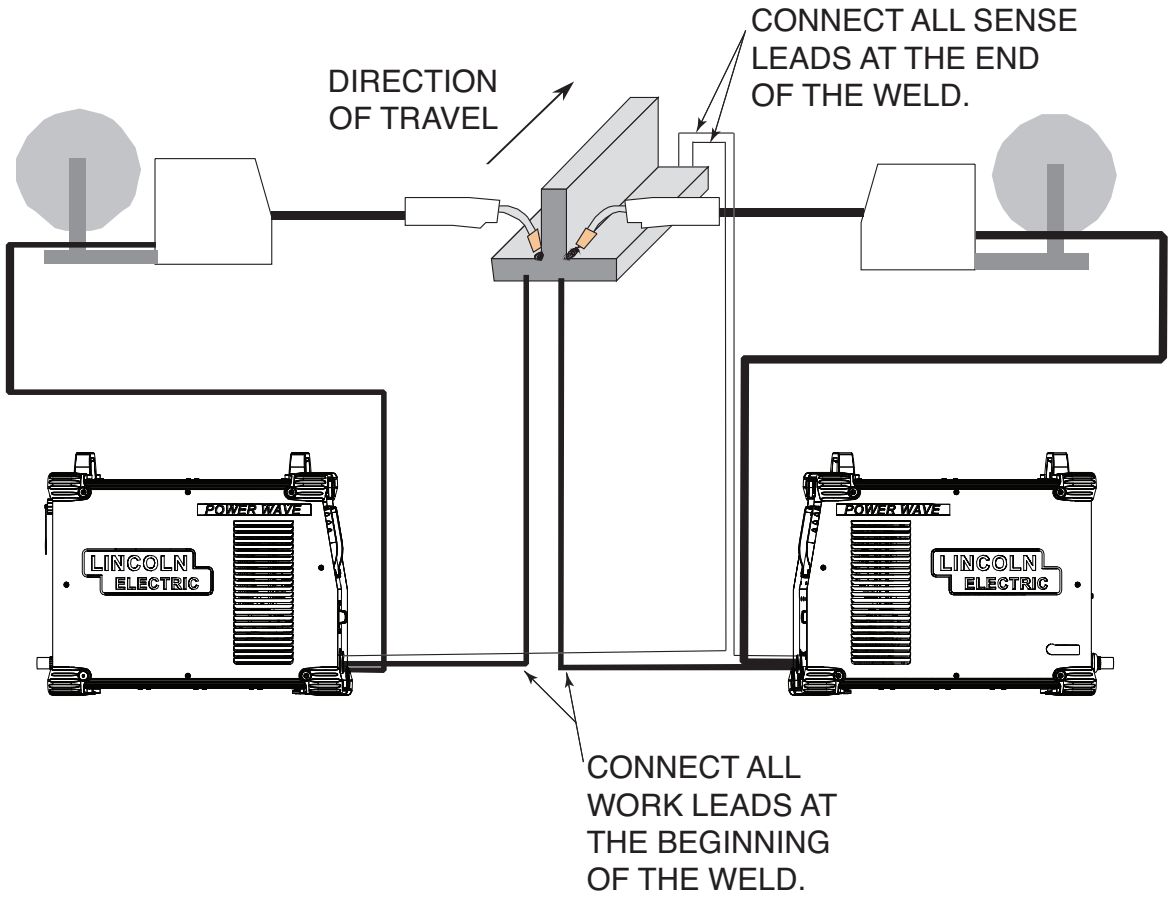
If Sense Leads ARE Used:

- Position the sense leads out of the path of the weld current. Especially any current paths common to adjacent arcs. Current from adjacent arcs can induce voltage into each others current paths that can be misinterpreted by the power sources, and result in arc interference.

- For longitudinal applications, connect all work leads at one end of the weldment, and all of the work voltage sense leads at the opposite end of the weldment. Perform welding in the direction away from the work leads and toward the sense leads.

(See Figure A.7)

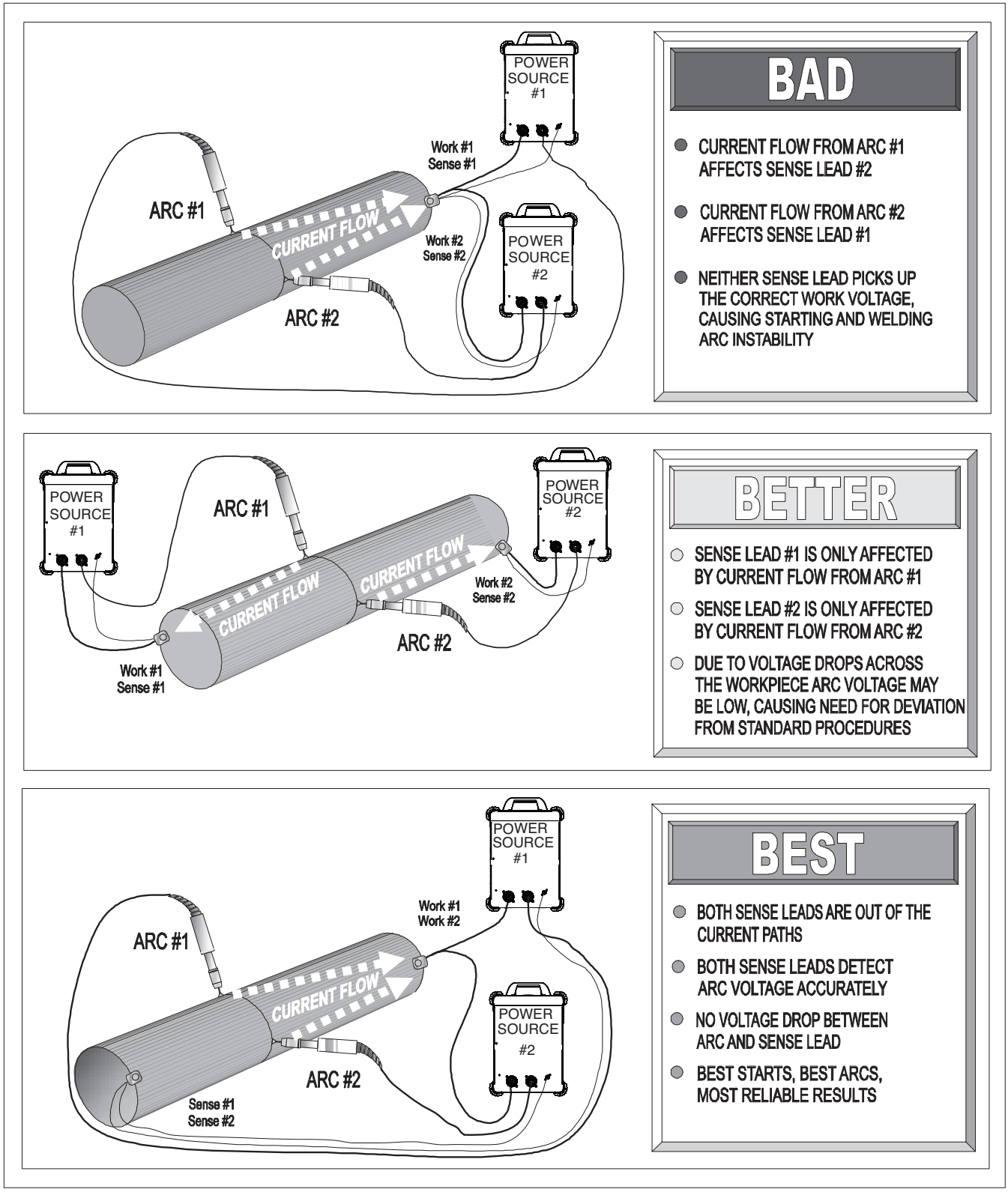
FIGURE A.7



Return to Section TOC
Return to Master TOC

- For circumferential applications, connect all work leads on one side of the weld joint, and all of the work voltage sense leads on the opposite side, such that they are out of the current path. (See Figure A.8)

FIGURE A.8



Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

CONTROL CABLE CONNECTIONS

General Guidelines

Genuine Lincoln control cables should be used at all times (except where noted otherwise). Lincoln cables are specifically designed for the communication and power needs of the Power Wave / Power Feed systems. Most are designed to be connected end to end for ease of extension. Generally, it is recommended that the total length not exceed 100ft. (30.5m). The use of non-standard cables, especially in lengths greater than 25 feet, can lead to communication problems (system shutdowns), poor motor acceleration (poor arc starting), and low wire driving force (wire feeding problems). Always use the shortest length of control cable possible, and DO NOT coil excess cable.

Regarding cable placement, best results will be obtained when control cables are routed separate from the weld cables. This minimizes the possibility of interference between the high currents flowing through the weld cables, and the low level signals in the control cables. These recommendations apply to all communication cables including ArcLink® and Ethernet connections.

Product specific Installation Instructions

Connection Between Power Source and ArcLink® Compatible Wirefeeders (K1543 – ArcLink Control Cable)

The 5-pin ArcLink control cable connects the power source to the wire feeder. The control cable consists of two power leads, one twisted pair for digital communication, and one lead for voltage sensing. The 5-pin ArcLink connection on the Power Wave S350 is located on the rear panel above the power cord. The control cable is keyed and polarized to prevent improper connection. Best results will be obtained when control cables are routed separate from the weld cables, especially in long distance applications. The recommended combined length of the ArcLink control cable network should not exceed 200ft. (61.0m).

Connection Between Power Source and Ethernet Networks

The Power Wave S350 is equipped with an IP67 rated ODVA compliant RJ-45 Ethernet connector, which is located on the rear panel. All external Ethernet equipment (cables, switches, etc.), as defined by the connection diagrams, must be supplied by the customer. It is critical that all Ethernet cables external to either a conduit or an enclosure are solid conductor, shielded cat 5e cable, with a drain. The drain should be grounded at the source of transmission. For best results, route Ethernet cables away from weld cables, wire drive control cables, or any other current carrying device that can create a fluctuating magnetic field. For additional guidelines refer to ISO/IEC 11801. Failure to follow these recommendations can result in an Ethernet connection failure during welding.

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

TABLE OF CONTENTS - OPERATION SECTION

Operation **B-1**

Safety Precautions B-2

Graphic Symbols B-2

Power-Up Sequence B-2

Duty Cycle B-2

Product Description B-3

Recommended Processes and Equipment B-3

Equipment Limitations B-3

Design Features B-4

Case Front Controls B-5

Case Back Controls B-5

Common Welding Procedures B-6/B-8

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SAFETY PRECAUTIONS

READ AND UNDERSTAND ENTIRE SECTION BEFORE OPERATING MACHINE.

⚠ WARNING

- **ELECTRIC SHOCK CAN KILL.**
- **Do not touch electrically live part or electrode with skin or wet clothing.**
- **Insulate yourself from work and ground.**
- **Always wear dry insulating gloves.**
- **Do not operate with covers, panels or guards removed or open.**

- **FUMES AND GASSES can be dangerous.**
- **Keep your head out of fumes.**
- **Use ventilation or exhaust to remove fumes from breathing zone.**

- **WELDING SPARKS can cause fire or explosion.**
- **Keep flammable material away.**

ARC RAYS can burn.

- **Wear eye, ear and body protection.**

SEE ADDITIONAL WARNING INFORMATION UNDER ARC WELDING SAFETY PRECAUTIONS AND IN THE FRONT OF THIS OPERATING MANUAL.

GRAPHIC SYMBOLS THAT APPEAR ON THIS MACHINE OR IN THIS MANUAL

WARNING OR CAUTION

DANGEROUS VOLTAGE

POSITIVE OUTPUT

NEGATIVE OUTPUT

HIGH TEMPERATURE

STATUS

PROTECTIVE GROUND

EXPLOSION

POWER-UP SEQUENCE

When the POWER WAVE® S350 is powered up, it can take as long as 30 seconds for the machine to be ready to weld. During this time period the user interface will not be active.

DUTY CYCLE

The duty cycle is based on a ten-minute period. A 40% duty cycle represents 4 minutes of welding and 6 minutes of idling in a ten-minute period. Refer to the technical specification section for the Power Wave S350's duty cycle ratings.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

PRODUCT DESCRIPTION

PRODUCT SUMMARY

The Power Wave® S350 is a portable multi-process power source with high-end functionality capable of Stick, DC TIG, MIG, Pulsed MIG and Flux-Cored welding. It is ideal for a wide variety of materials including aluminum, stainless, and nickel — where arc performance is critical.

The Power Wave® S350 is designed to be a very flexible welding system. Like existing POWER WAVEs, the software based architecture allows for future upgradeability. One significant change from the current range of Power Wave units is that the Ethernet communication feature is standard on the Power Wave® S350 which allows for effortless software upgrades through Powerwavesoftware.com. The Ethernet communication also gives the Power Wave® S350 the ability to run Production Monitoring™ 2. Also a Devicenet option which will allow the Power Wave® S350 to be used in a wide range of configurations. Also, the Power Wave® S350 is designed to be compatible with future advanced welding modules like STT.

RECOMMENDED PROCESSES AND EQUIPMENT

The Power Wave® S350 is recommended for semiautomatic welding, and may also be suitable for basic hard automation applications. The Power Wave® S350 can be set up in a number of configurations, some requiring optional equipment or welding programs.

RECOMMENDED EQUIPMENT

The Power Wave® S350 is designed to be compatible with the current range of Power Feed™ systems including future versions of ArcLink® feeders.

RECOMMENDED PROCESSES

The Power Wave S350 is a high speed, multi-process power source capable of regulating the current, voltage, or power of the welding arc. With an output range of 5 to 350 amperes, it supports a number of standard processes including synergic GMAW, GMAW-P, FCAW, FCAW-SS, SMAW, GTAW and GTAW-P on various materials especially steel, aluminum and stainless.

PROCESS LIMITATIONS

The software based weld tables of the Power Wave S350 limit the process capability within the output range and the safe limits of the machine. In general the processes will be limited to .030-.052 solid steel wire, .030-.045 stainless wire, .035-1/16 cored wire, and .035 and 1/16 Aluminum wire.

EQUIPMENT LIMITATIONS

Only ArcLink compatible semiautomatic wire feeders and users interfaces may be used. If other Lincoln wire feeders or non-Lincoln wire feeders are used there will be limited process capability and performance and features will be limited.

DESIGN FEATURES

Loaded with Standard Features

- Multiple process DC output range: 5 - 350 Amps
- 200 – 600 VAC, 1/3 phase, 50-60Hz input power
- New and Improved Line Voltage Compensation holds the output constant over wide input voltage fluctuations.
- Utilizes next generation microprocessor control, based on the ArcLink® platform.
- State of the art power electronics technology yields superior welding capability.
- Electronic over current protection
- Input over voltage protection.
- F.A.N. (fan as needed). Cooling fan only runs when needed.
- Thermostatically protected for safety and reliability.
- Recessed connection panel for protection against accidental impact.
- Ethernet connectivity via IP-67 rated ODVA compliant RJ-45 connector.
- Panel mounted Status and Thermal LED indicators facilitate quick and easy troubleshooting.
- Potted PC boards for enhanced ruggedness/reliability.
- Enclosure reinforced with heavy duty aluminum extrusions for mechanical toughness
- Remote control/Foot amptrol ready.
- Waveform Control Technology™ for good weld appearance and low spatter, even when welding nickel alloys.

Return to Section TOC
Return to Master TOC

CASE FRONT CONTROLS

(See Figure B.1)

1. **USER INTERFACE (optional)**
2. **STATUS LED -** (See Troubleshooting Section for operational functions)
3. **THERMAL LED -** Indicates when machine has thermal fault.
4. **POWER SWITCH -** Controls power to the Power Wave® S350.
5. **WORK STUD**
6. **ELECTRODE STUD**
7. **WORK SENSE LEAD**
8. **6-PIN REMOTE**

CASE BACK CONTROLS

(See Figure B.2)

1. **115 VAC RECEPTACLE AND CIRCUIT BEAKER (OPTIONAL)**
2. **ARCLINK (RECEPTACLE AND CIRCUIT BREAKER)**
3. **RESERVED FOR FUTURE DEVELOPMENT**
4. **DEVICENET KIT (OPTIONAL)**
5. **ETHERNET**
6. **RESERVED FOR FUTURE DEVELOPMENT**
7. **SOLENOID KIT (OPTIONAL)**
8. **INPUT POWER CORD**

FIGURE B.1

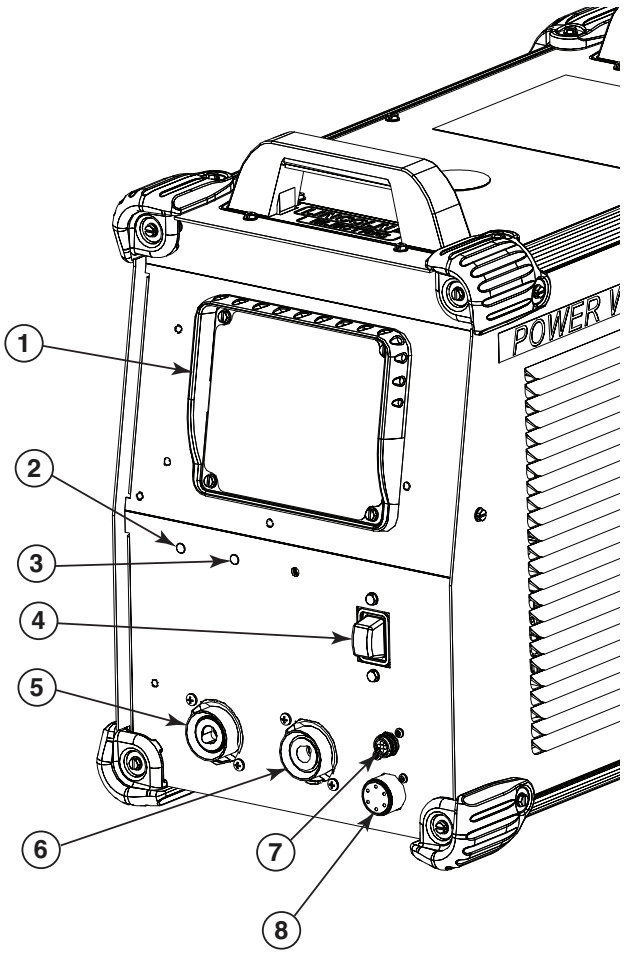
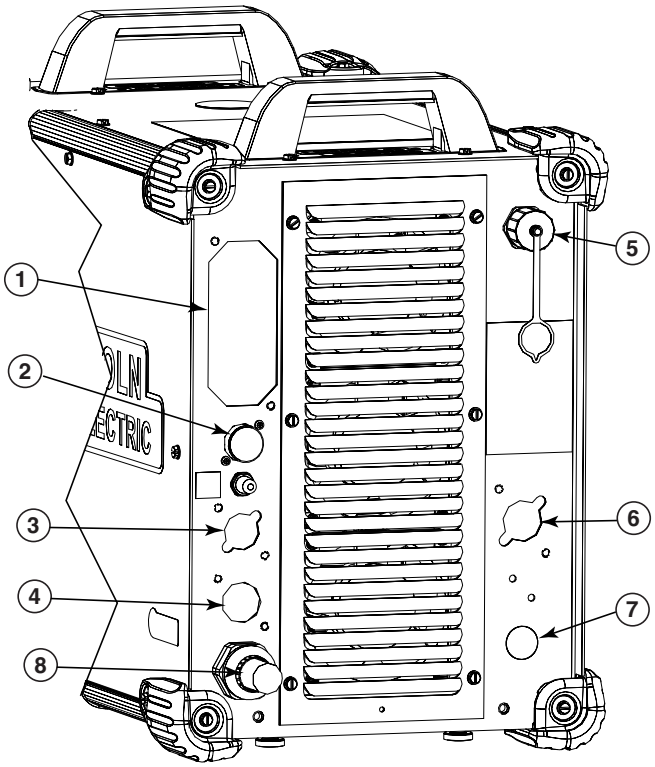


FIGURE B.2



Return to Section TOC
Return to Master TOC

COMMON WELDING PROCEDURES

⚠ WARNING

MAKING A WELD

The serviceability of a product or structure utilizing the welding programs is and must be the sole responsibility of the builder/user. Many variables beyond the control of The Lincoln Electric Company affect the results obtained in applying these programs. These variables include, but are not limited to, welding procedure, plate chemistry and temperature, weldment design, fabrication methods and service requirements. The available range of a welding program may not be suitable for all applications, and the build/user is and must be solely responsible for welding program selection.

Choose the electrode material, electrode size, shielding gas, and process (GMAW, GMAW-P etc.) appropriate for the material to be welded.

Select the weld mode that best matches the desired welding process. The standard weld set shipped with the Power Wave S350 encompasses a wide range of common processes that will meet most needs. If a special weld mode is desired, contact the local Lincoln Electric sales representative.

All adjustments are made through the user interface. Because of the different configuration options your system may not have all of the following adjustments.
See Accessories Section for Kits and Options available to use with the Power Wave® S350.

Definition of Welding Modes

NON-SYNERGIC WELDING MODES
- A Non-synergic welding mode requires all welding process variables to be set by the operator.

SYNERGIC WELDING MODES
- A Synergic welding mode offers the simplicity of single knob control. The machine will select the correct voltage and amperage based on the Wire Feed Speed (WFS) set by the operator.

Basic Welding Controls

Weld Mode
Selecting a weld mode determines the output characteristics of the Power Wave power source. Weld modes are developed with a specific electrode material, electrode size, and shielding gas. For a more complete description of the weld modes programmed into the Power Wave® S350 at the factory, refer to the Weld Set Reference Guide supplied with the machine or available at **www.powerwavesoftware.com.**

Wire Feed Speed (WFS)
In synergic welding modes (synergic CV, GMAW-P), WFS is the dominant control parameter. The user adjusts WFS according to factors such as wire size, penetration requirements, heat input, etc. The Power Wave® S350 then uses the WFS setting to adjust the voltage and current according to settings contained in the Power Wave.

In non-synergic modes, the WFS control behaves like a conventional power source where WFS and voltage are independent adjustments. Therefore, to maintain proper arc characteristics, the operator must adjust the voltage to compensate for any changes made to the WFS.

Amps
In constant current modes, this control adjusts the welding amperage.

Volts
In constant voltage modes, this control adjusts the welding voltage.

Trim
In pulse synergic welding modes, the Trim setting adjusts the arc length. Trim is adjustable from 0.50 to 1.50. 1.00 is the nominal setting and is a good starting point for most conditions.

UltimArc™ Control
UltimArc™ Control allows the operator to vary the arc characteristics. UltimArc™ Control is adjustable from –10.0 to +10.0 with a nominal setting of 0.0.

Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

SMAW (STICK) WELDING

The welding current and Arc Force settings can be set through a Power Feed 10M or Power Feed 25M wire feeder. Alternatively an optional Stick / TIG UI (K2828-1) can be installed into the power source to control these settings locally.

In a SMAW (STICK mode), Arc Force can be adjusted. It can be set to the lower range for a soft and less penetrating arc characteristic (negative numeric values) or to the higher range (positive numeric values) for a crisp and more penetrating arc. Normally, when welding with cellulosic types of electrodes (E6010, E7010, E6011), a higher energy arc is required to maintain arc stability. This is usually indicated when the electrode sticks to the work-piece or when the arc becomes unstable during manipulative technique. For low hydrogen types of electrodes (E7018, E8018, E9018, etc.) a softer arc is usually desirable and the lower end of the Arc Control suits these types of electrodes. In either case the arc control is available to increase or decrease the energy level delivered to the arc.

GTAW (TIG) WELDING

The welding current can be set through a Power Feed 10M or Power Feed 25M wire feeder. Alternatively an optional Stick / TIG UI (K2828-1) can be installed into the power source to control these settings locally.

The TIG mode features continuous control from 5 to 350 amps with the use of an optional foot amptrol (K870). The Power Wave® S350 can be run in either a Touch Start TIG mode or Scratch start TIG mode.

CONSTANT VOLTAGE WELDING

Synergic CV

For each wire feed speed, a corresponding voltage is preprogrammed into the machine through special software at the factory.

The nominal preprogrammed voltage is the best average voltage for a given wire feed speed, but may be adjusted to preference. When the wire feed speed changes, the Power Wave® S350 automatically adjusts the voltage level correspondingly to maintain similar arc characteristics throughout the WFS range.

Non Synergic CV

In non-synergic modes, the WFS control behaves more like a conventional CV power source where WFS and voltage are independent adjustments. Therefore to maintain the arc characteristics, the operator must adjust the voltage to compensate for any changes made to the WFS.

All CV Modes

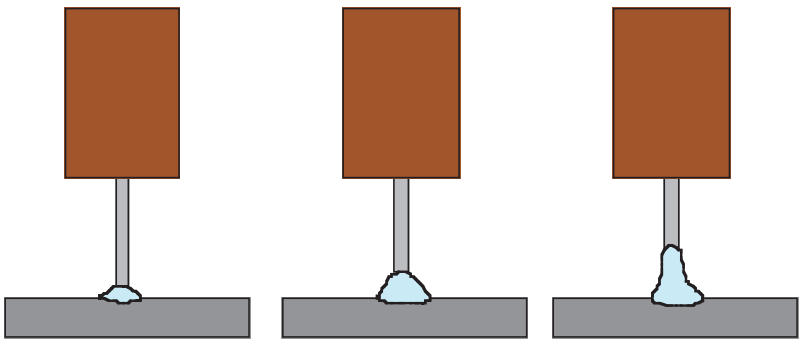
Pinch adjusts the apparent inductance of the wave shape. The “pinch” function is inversely proportional to inductance. Therefore, increasing Pinch Control greater than 0.0 results in a crisper arc (more spatter) while decreasing the Pinch Control to less than 0.0 provides a softer arc (less spatter).

PULSE WELDING

Pulse welding procedures are set by controlling an overall “arc length” variable. When pulse welding, the arc voltage is highly dependent upon the waveform. The peak current, back ground current, rise time, fall time and pulse frequency all affect the voltage. The exact voltage for a given wire feed speed can only be predicted when all the pulsing waveform parameters are known. Using a preset voltage becomes impractical and instead the arc length is set by adjusting “trim”.

Trim adjusts the arc length and ranges from 0.50 to 1.50 with a nominal value of 1.00. Trim values greater than 1.00 increase the arc length, while values less than 1.00 decrease the arc length. (See figure B.3)

FIGURE B.3

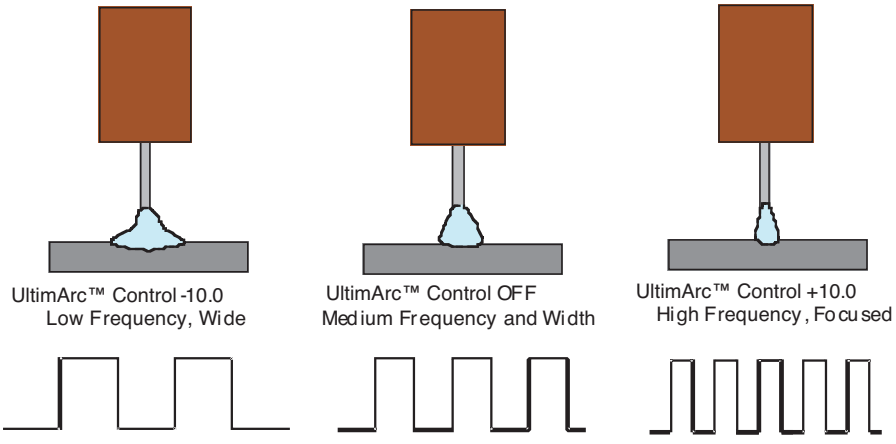


Most pulse welding programs are synergic. As the wire feed speed is adjusted, the Power Wave® S350 will automatically recalculate the waveform parameters to maintain similar arc properties.

The Power Wave® S350 utilizes “adaptive control” to compensate for changes in the electrical stick-out while welding. (Electrical stick-out is the distance from the contact tip to the work piece.) The Power Wave® S350 waveforms are optimized for a 0.75” stick-out. The adaptive behavior supports a range of stick-outs from 0.50 to 1.25”. At very low or high wire feed speeds, the adaptive range may be less due to reaching physical limitations of the welding process.

UltimArc™ Control adjusts the focus or shape of the arc. UltimArc™ Control is adjustable from -10.0 to +10.0 with a nominal setting of 0.0. Increasing the UltimArc™ Control increases the pulse frequency and background current while decreasing the peak current. This results in a tight, stiff arc used for high speed sheet metal welding. Decreasing the UltimArc™ Control decreases the pulse frequency and background current while increasing the peak current. This results in a soft arc good for out of position welding. (See Figure B.4)

FIGURE B.4



Return to Section TOC
Return to Master TOC

TABLE OF CONTENTS - ACCESSORIES SECTION

Accessories **C-1**

Kits, Options / Accessories C-2

Field Installed Options C-2/C-3

Stick Options C-3/C-4

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

KITS, OPTIONS AND ACCESSORIES

All Kits Options and Accessories are found on the Web site: (**www.lincolnelectric.com)**

FACTORY INSTALLED

None Available

FIELD INSTALLED OPTIONS

GENERAL OPTIONS

Stick / Tig User Interface Kit
Mounts inside the front panel of the Power Wave S350. Allows stick and Tig operation without having a wire feeder.
Order K2828-1

115 VAC Auxiliary Power Kit
Mounts inside the back of the Power Wave S350. Adds 115 VAC / 60 Hz auxiliary power capability to the Power Wave S350 (only compatible with the K2823-1 power source)
Order K2829-1

DeviceNet Kit
Mounts inside the back of the Power Wave S350. Allows Devicenet objects to communicate with the Power Wave S350.
Order K2827-1

Work Voltage Sense Lead Kit
Required to accurately monitor voltage at the arc.
Order K940-25 for 25 ft. (7.6 m)
Order K1811-75 for 75 ft. (22.9 m)

Deluxe Adjustable Gas Regulator & Hose Kit
Accommodates CO_2, Argon, or Argon-blend gas cylinders. Includes a cylinder pressure gauge, dual scale flow gauge and 4.3 ft. (1.3 m) gas hose.
Order K586-1

Work and Wire Feeder 2/0 Weld Cable Package
Includes Twist-Mate™ connectors, work clamps, 15 ft. (4.5 m) work cable and 10 ft. (3.0 m) electrode cable. Rated 350 amps, 60% duty cycle.
Order K1803-1

Twist-Mate™ Cable Plug
For connecting welding cable to output terminal receptacles. For 1/0-2/0 (50-70 mm^2) cable.
Order K852-70

Twist-Mate™ Cable Plug
For connecting welding cable to output terminal receptacles. For 2/0-3/0 (70-95 mm^2) cable.
Order K852-95

Twist-Mate™ Cable Receptacle
For connecting welding cable to Twist-Mate™ Cable Plug.
Order K1759-70 for 1/0-2/0 (50-70 mm2) cable
Order K1759-95 for 2/0-3/0 (70-95mm2) cable

Twist-Mate™ to Lug Adapter
For connection of lugged cable to Twist-Mate™ connectors. 18" (457 mm) long.
Order K2176-1

Inverter and Wire Feeder Cart
Rear-wheeled cart includes front casters and no-lift gas bottle platform. Convenient handles allow for easy cable storage while full length side trays store parts and tools. Shipped fully assembled. Small footprint fits through 30" (762 mm) door.
Order K1764-1 Dual Cylinder Kit

Dual Cylinder Kit
Permits side-by-side mounting of two full size gas cylinders, with easy loading. For use with K1764-1 cart.
Order K1702-1

Coaxial Welding Cable
Optimum weld cables for minimizing cable inductance and optimizing welding performance.
Order K1796-25 for 25 feet 25 ft. (7.6 m) cable length.
Order K1796-50 for 50 feet 50 ft. (15.2 m) cable length.
Order K1796-75 for 75 feet 75 ft. (22.9 m) cable length.
Order K1796-100 for 100 feet 100 ft. (30.5 m) cable length.

Welding Fume Extractors
Lincoln offers a wide range of fume extraction environmental system solutions, ranging from portable systems easily wheeled around a shop to shop-wide central systems servicing many dedicated welding stations.
Request Lincoln publication E13.40
(See **www.lincolnelectric.com**)

Return to Section TOC
Return to Master TOC

STICK OPTIONS

ACCESSORY KIT - 150 Amp

For stick welding. Includes 20 ft. (6.1m) #6 electrode cable with lug, 15 ft. (4.6m) #6 work cable with lugs, headshield, filter plate, work clamp, electrode holder and sample pack of mild steel electrode. For use with K2176-1 (Twist-Mate™ to Lug Adapter)
ORDER K875

ACCESSORY KIT - 400 AMP

For stick welding. Includes 35 ft. (10.7m) 2/0 electrode cable with lug, 30 ft. (9.1m) 2/0 work cable with lugs, headshield, filter plate, work clamp and electrode holder. For use with K2176-1 (Twist-Mate™ to Lug Adapter)
ORDER K704

REMOTE OUTPUT CONTROL

Portable current control provides the same dial range as the current control on the welder. Consists of a 6-pin Amphenol connector which plugs into the remote control Amphenol. 25 foot cable length.
ORDER K857
ORDER K857-1 for 100 ft. (30 m)

STICK ELECTRODE HOLDER AND CABLE ASSEMBLY

Includes 200A stick electrode holder and Twist-Mate connector. 12.5 ft. cable length.
ORDER K2374-1

STICK ELECTRODE HOLDER CABLE AND WORK CABLE ASSEMBLY

Includes 200A stick electrode holder, welding cable, work clamp and Twist-Mate adapter.
ORDER K2394-1

TIG OPTIONS

Power Wave S350 Solenoid Kit

Mounts inside the back of the Power Wave S350. Switches gas flow in the Power Wave S350 through the Twist-Mate™ connector. Includes gas hose and solenoid (only compatible with the K2823-1 power source).
Order K2825-1

Pro-Torch™ TIG Torches

A full line of air-cooled and water-cooled torches available.
Request Lincoln publication E12.150
(See **www.lincolnelectric.com**)

Hand Amptrol®

Provides 25 ft. (7.6 m) of remote current control for TIG welding. (6-pin plug connection)
Order K963-3

Foot Amptrol®

Provides 25 ft. (7.6 m) of remote current control for TIG welding. (6-pin plug connection).
Order K870

Arc Start Switch

May be used in place of the Foot or Hand Amptrol®. Comes with a 25 ft. (7.6 m) cable. Attaches to the TIG torch for convenient finger control to start and stop the weld cycle at the current set on the machine.
Order K814

Twist-Mate™ Torch Adapter

For connection of Pro-Torch™ TIG torches (1 piece cable) to power sources with gas passing through the Twist-Mate™ connection. For use with K2825-1.
Order K1622-1 For air-cooled PTA-9 or PTA-17 torches.
Order K1622-3 For air-cooled PTA-26 torches.
Order K1622-2 For water-cooled torches.

Twist-Mate™ Torch Adapter

For connection of PTA-9 or PTA-17V torches (1 piece cable) to power sources without gas passing through the Twist-Mate™ connection.
Order K960-1

TIG-Mate™ 17V Air-Cooled TIG Torch Starter Pack
Get everything you need for TIG welding in one complete easy-to-order kit packaged in its own portable carrying case. Includes: PTA-17V torch, parts kit, Harris® flowmeter/regulator, 10 ft. (3.0 m) gas hose, and work clamp and cable.
Order K2265-1

TIG-Mate™ 17 Air-Cooled TIG Torch Starter Pack
Get everything you need for TIG welding in one complete easy-to-order kit packaged in its own portable carrying case. Includes: PTA-17 torch, parts kit, Harris® flowmeter/regulator, 10 ft. (3.0 m) gas hose, Twist-mate™ adapter, and work clamp and cable.
Order K2266-1

TIG-Mate™ 20 Water-Cooled TIG Torch Starter Pack
Get everything you need for TIG welding in one complete easy-to-order kit packaged in its own portable carrying case. Includes: PTW-20 torch, parts kit, Harris® flowmeter/regulator, 10 ft. (3.0 m) gas hose, Twist-Mate™ adapter, work clamp and cable and 10 ft. (3.0 m) water hose.
Order K2267-1

MIG OPTIONS

Work and Feeder Welding Cables
350 amps, 60% duty cycle with Twist-Mate connectors and Ground Clamp.
Order K1803-1

COMPATIBLE LINCOLN EQUIPMENT

Any Arclink compatible wire feeding equipment
(See **www.lincolnelectric.com**)

Return to Section TOC
Return to Master TOC

TABLE OF CONTENTS - MAINTENANCE SECTION

Maintenance **D-1**

Safety Precautions D-2

Routine Maintenance D-2

Periodic Maintenance D-2

Calibration Specification D-2

Major Component Location D-3

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SAFETY PRECAUTIONS

⚠ WARNING

ELECTRIC SHOCK can kill.

- **Do not operate with covers removed.**
- **Turn off power source before installing or servicing.**
- **Do not touch electrically hot parts.**

- **Turn the input power to the welding power source off at the fuse box before working in the terminal strip.**
- **Only qualified personnel should install, use or service this equipment.**

ROUTINE MAINTENANCE

Routine maintenance consists of periodically blowing out the machine, using a low-pressure air stream, to remove accumulated dust and dirt from the intake and outlet louvers, and the cooling channels in the machine.

PERIODIC MAINTENANCE

Calibration of the Power Wave® S350 is critical to its operation. Generally speaking the calibration will not need adjustment. However, neglected or improperly calibrated machines may not yield satisfactory weld performance. To ensure optimal performance, the calibration of output Voltage and Current should be checked yearly.

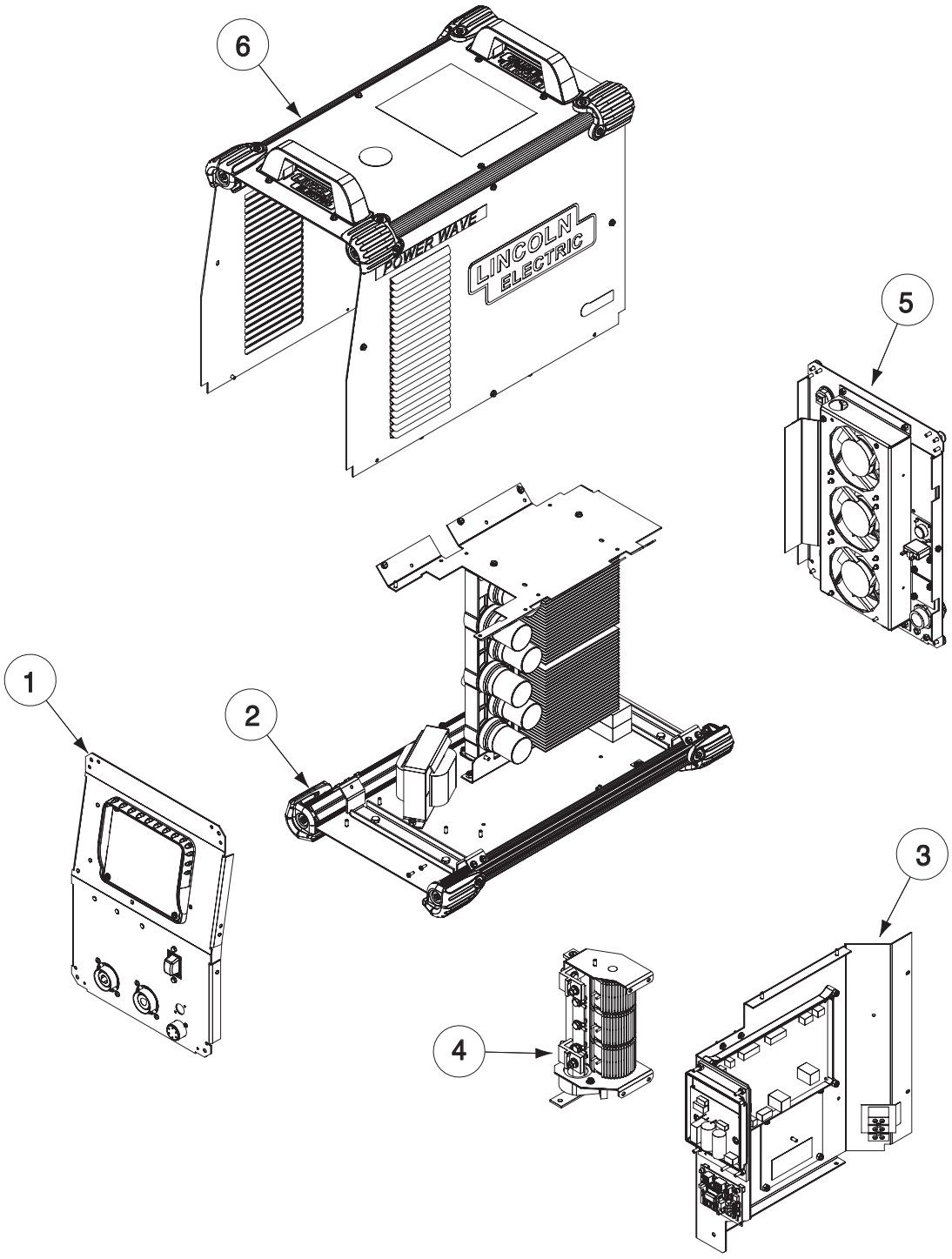
CALIBRATION SPECIFICATION

Output Voltage and Current are calibrated at the factory. Generally the machine calibration will not need adjustment. However, if the weld performance changes, or the yearly calibration check reveals a problem, use the calibration section of the **Diagnostics Utility** to make the appropriate adjustments.

The calibration procedure itself requires the use of a grid, and certified actual meters for voltage and current. The accuracy of the calibration will be directly affected by the accuracy of the measuring equipment you use. The **Diagnostics Utility** includes detailed instructions, it is refered to on the **Service Navigator DVD** or is available at **www.powerwavesoftware.com**.

1. FRONT PANEL ASSEMBLY
2. BASE AND POWER ASSEMBLY
3. VERTICAL DIVIDER PANEL ASSEMBLY
4. OUTPUT CHOKE ASSEMBLY
5. CASE BACK AND FAN ASSEMBLY
6. ROOF AND SIDES ASSEMBLY

MAJOR COMPONENT LOCATION



Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

TABLE OF CONTENTS-THEORY OF OPERATION SECTION

Theory of Operation E-1

General Description E-2

Main Input Switch, Input Rectifier, Soft Start/Input Relay, DC Link Capacitor, Buck-Boost and Power Factor Correction Board E-3

Planar Transformer, Output Rectification and Filtering E-4

Multi-Phase Chopper, Chopper Control Board, Current Transducer and Control Board E-5

DC Bus Board and Optional User Interface Board E-6

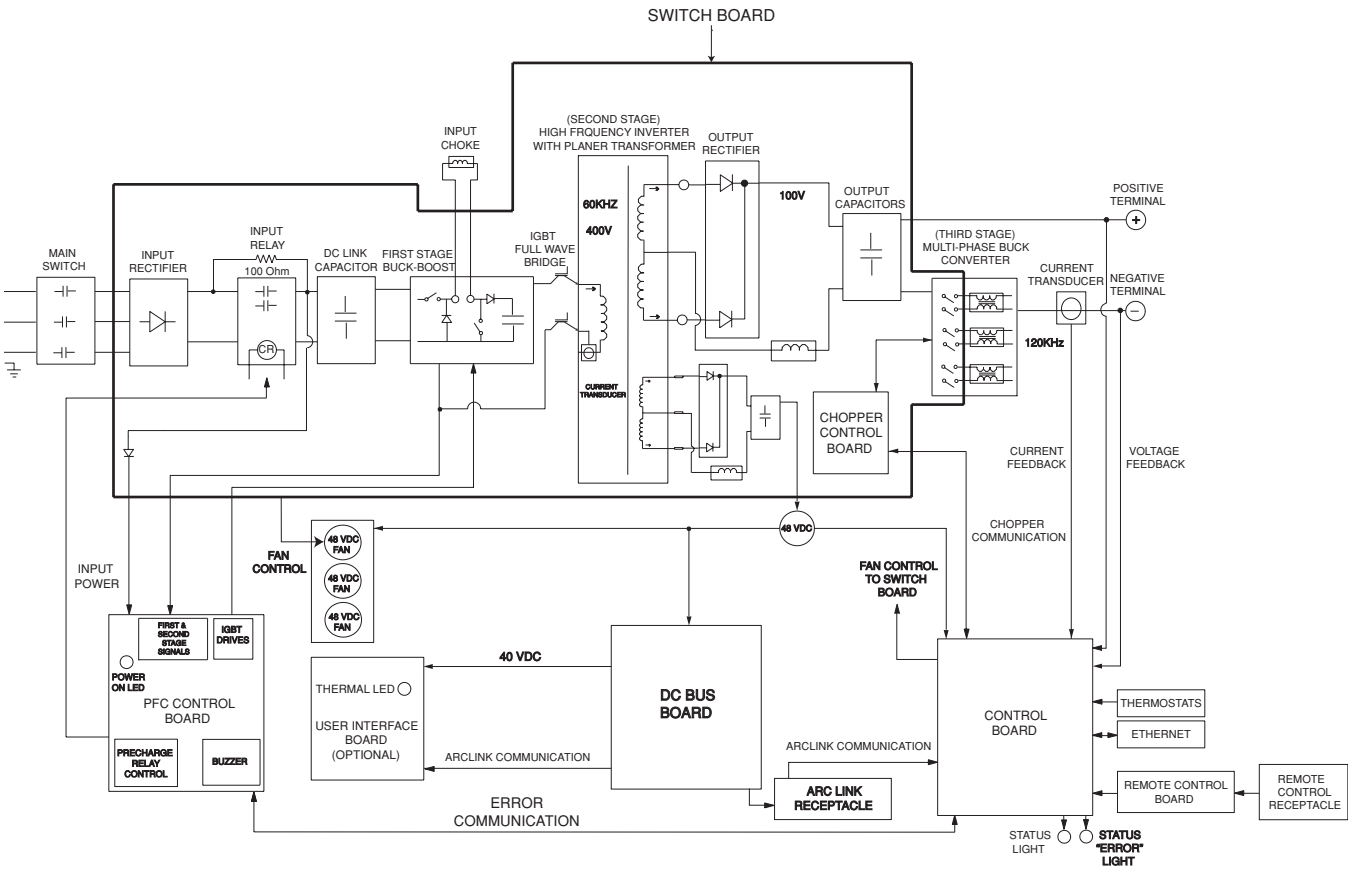
Machine Protection E-7

Pulse Width Modulation E-8

Minimum / Maximum Output E-8

Insulated Gate Bipolar Transistor (IGBT) Operation E-9

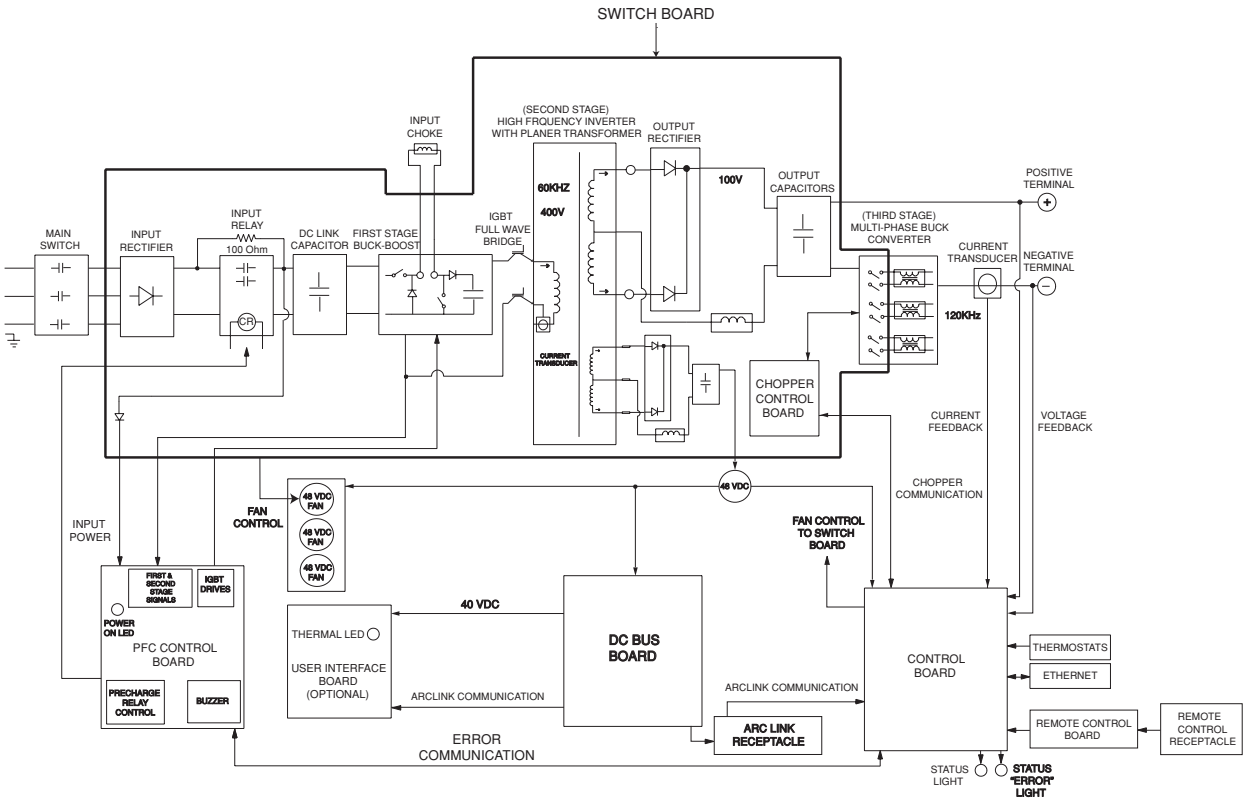
FIGURE E.1 BLOCK LOGIC DIAGRAM



LINCOLN ELECTRIC

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

FIGURE E.2 - GENERAL DESCRIPTION



GENERAL DESCRIPTION

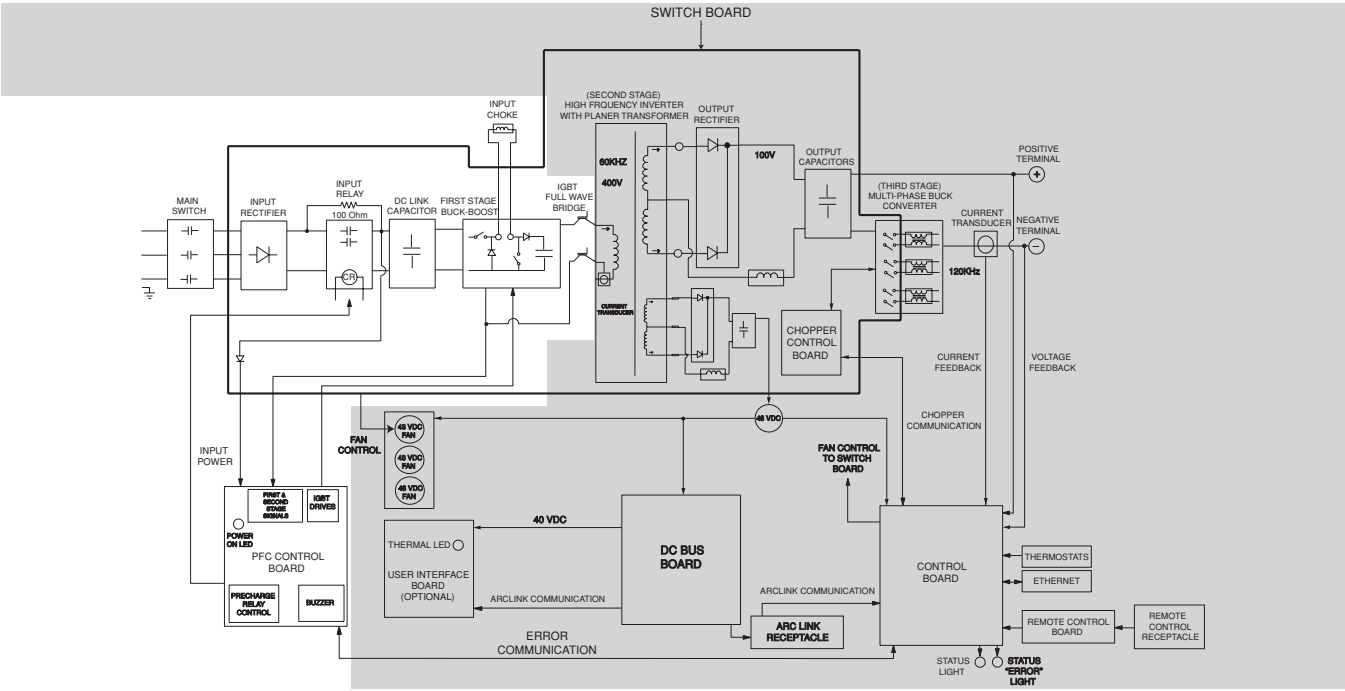
The POWER WAVE S350 is a welder featuring an inverter type power source with Tribrid Converter Technology and Automatic PowerConnect Technology with high-end functionality. The POWER WAVE S350 machine is a high performance multi-process machine with GMAW, FCAW, MMA, DC TIG and pulse capability. The S350 is capable of regulating the current, voltage and power of the welding arc. It offers premier welding performance solutions for specific areas such as aluminum, stainless and nickel especially where machine size and weight are considerations.

One significant improvement is that the Ethernet communication feature is standard on the Power Wave S350 machine. This allows for effortless software upgrades through PowerWavesoftware.com. The Ethernet communication also gives the POWER WAVE S350 the ability to run Production Monitoring 2. The POWER WAVE S350 is designed to be compatible with future advanced welding modules such as STT. The POWER WAVE S350 is capable of producing a welding output from 5 to 350 amperes. It will operate on single and / or three phase input power from 208VAC to 575VAC. It is environmentally hardened to an IP23 rating for operating in difficult environments.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

Return to Section TOC
Return to Master TOC

FIGURE E.3 - MAIN INPUT SWITCH, INPUT RECTIFIER, SOFT START/INPUT RELAY, ETC.



MAIN INPUT SWITCH, INPUT RECTIFIER, SOFT START/INPUT RELAY, DC LINK CAPACITOR, BUCK-BOOST AND POWER FACTOR CORRECTION BOARD

The Power Wave S350 can be connected to a variety of both three-phase or single phase input voltages. The Power Wave S350 automatically adjusts to operate with different AC input voltages. No reconnect switch settings are required. The initial input power is applied through a line switch located on the lower front panel of the machine. This AC input voltage is applied to an input rectifier where it is rectified to a DC voltage. The DC voltage is then applied to a soft-start circuit consisting of a 100 ohm resistor and a DC relay. The rectified input power is also connected, through a blocking diode, to the Power Factor Correction Board.

Initially the DC relay is not activated and the incoming DC voltage is applied to the DC Link Capacitor via the 100 ohm resistor. This resistor functions as a current limiting device allowing the DC Link Capacitor to charge slowly. The PFC board uses the incoming DC voltage to create three separate 15VDC supplies. These auxiliary voltages are used to power the circuitry for the control circuits as well as the +15 volts for the Buck-Boost IGBTs and the soft start relay.

Under normal operating conditions the PFC board activates the soft start relay 50ms after input power is applied to the machine. The 100 ohm resistor will be "shorted out" by the relay's contacts and the full input potential will be applied to the DC Link Capacitor. The DC Link Capacitor also functions as a voltage clamp for the Buck-Boost circuit.

The Buck-Boost circuit, located on the switch board, consists of a buck converter followed by a boost converter. The boost switch is active when the input voltage is at 230VAC input or less. Under this condition the Buck switch is held on the entire time. The Buck switch is active when the input voltage is at 325VAC or more. Under this condition the Boost switch is not active for most of the time. The Buck-Boost circuit operates at 25kHz. The Buck-Boost circuit's output is a 400 volt regulated bus.

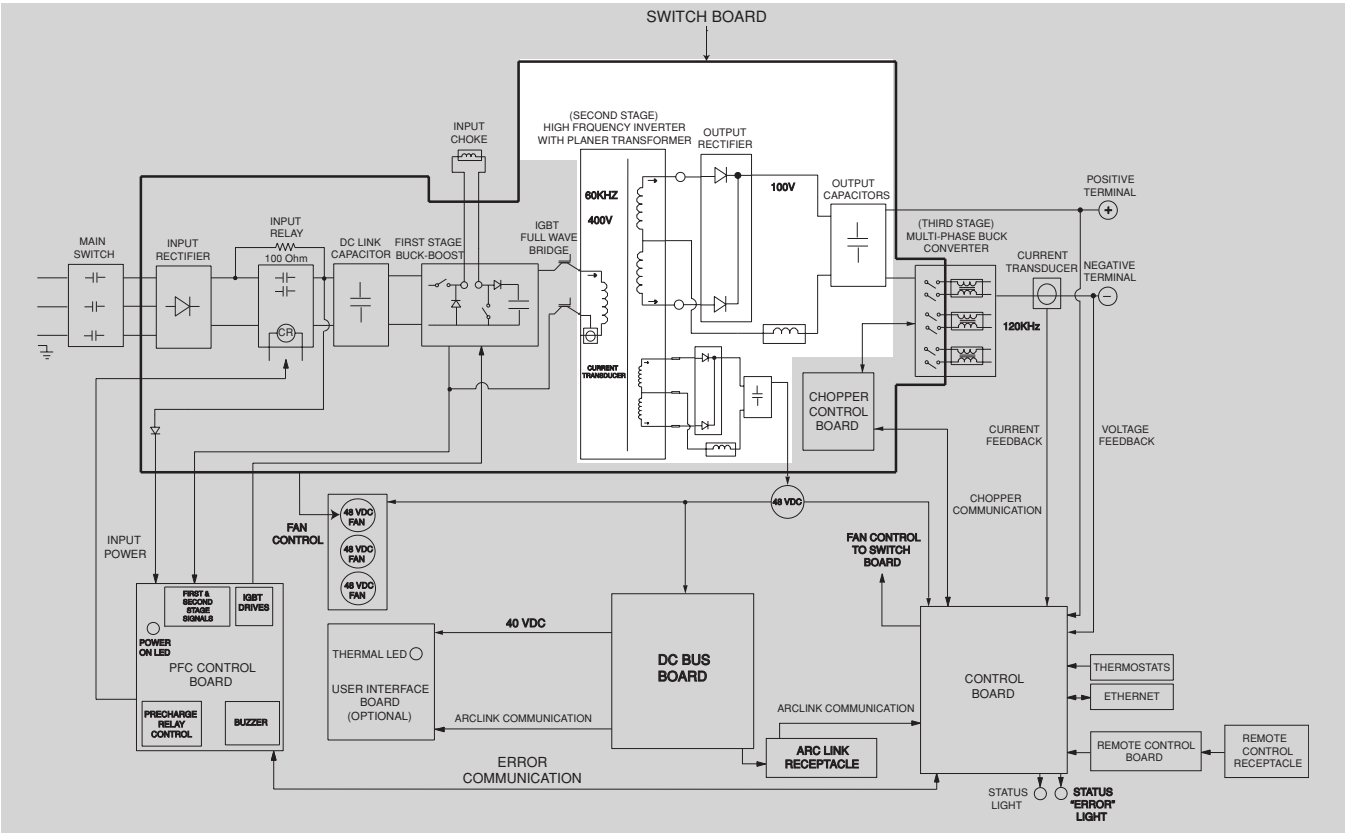
The output of the Buck Boost circuit is filtered and applied to an IGBT controlled full wave bridge inverter that is located on the switch board. The resultant 400 volt output is coupled to the primary winding of a Planar Transformer that is also located on the switch board. The full wave bridge operates at 60kHz. switching frequency with a 99% on time.

The PFC board controls the "firing" of the Buck Boost circuit and the IGBT full wave bridge circuit. This permits the PFC board to monitor and control the wave shape of the applied input current to provide a optimal power factor correction for the Power Wave S350.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

Return to Section TOC
Return to Master TOC

FIGURE E.4 - PLANAR TRANSFORMER, OUTPUT RECTIFICATION AND FILTERING



PLANAR TRANSFORMER, OUTPUT RECTIFICATION AND FILTERING

The Planar Transformer has two secondary windings. The 100 volt weld winding is center tapped and rectified. The 48 volt auxiliary winding is also center tapped and rectified. The term “Planar” refers to the design and construction of the transformer. The windings are created on printed circuit boards and stacked up to create a transformer.

The primary and secondary connections are oriented at opposite ends of the transformer. This type of assembly provides for tighter magnetic coupling between the primary and secondary windings resulting in lower leakage inductance, higher efficiency, cooler operation and reduced size.

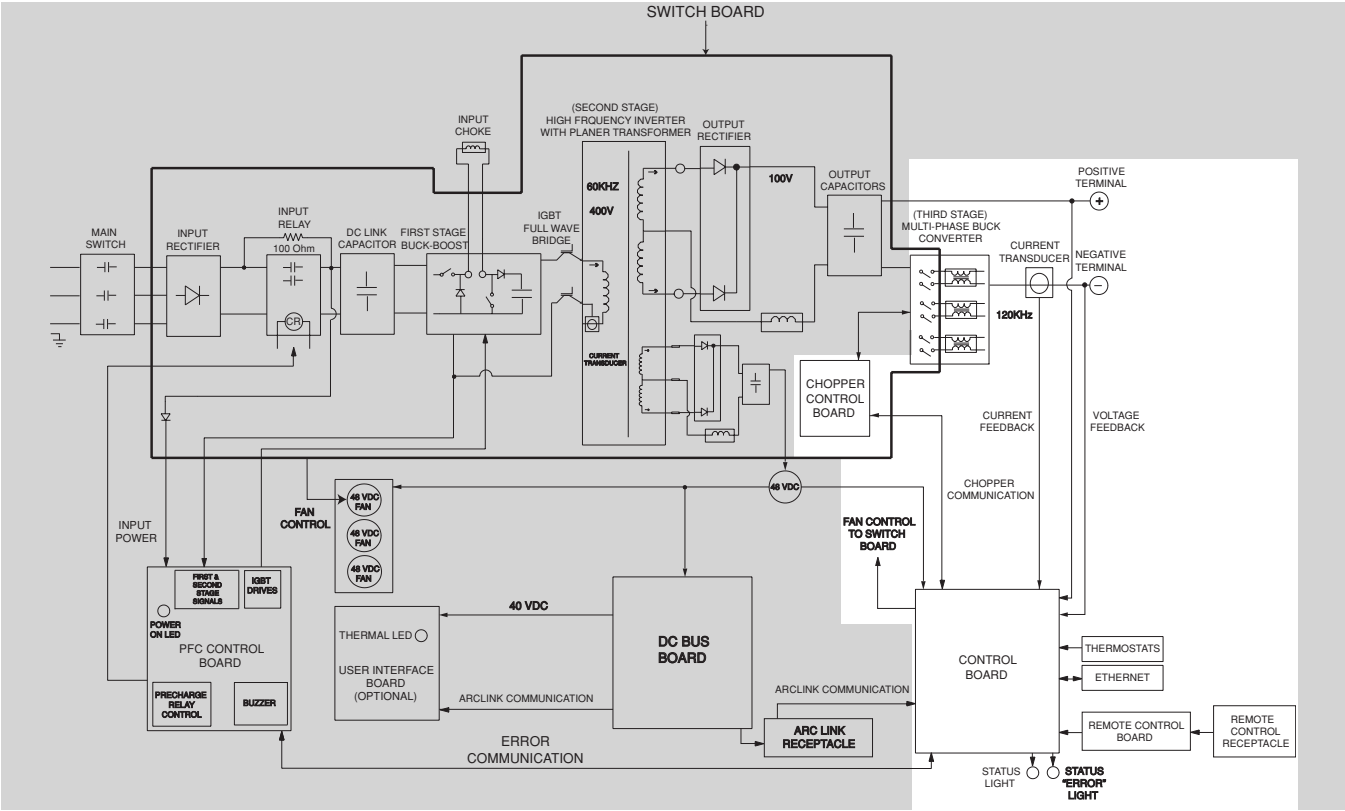
The 100 volt output of the weld winding is rectified and filtered by three capacitors and an inductor. This filtered DC voltage is applied to the multi-phase output chopper circuit.

The 48 volt output from the Planar Transformer’s auxiliary winding is also rectified and filtered and is used to provide power for the Fans, the Control Board, the DC Bus Board and the optional User Interface Board.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

Return to Section TOC
Return to Master TOC

FIGURE E.5 - CHOPPER, CURRENT TRANSDUCER AND CONTROL BOARDS



MULTI-PHASE CHOPPER, CHOPPER CONTROL BOARD, CURRENT TRANSDUCER AND CONTROL BOARD

The Multi-Phase Chopper is used to control the welding voltage and current output. It receives the 100 volt DC from the Planar transformer and produces a regulated output for welding purposes. It contains six chopper phases in parallel that turn on 60 degrees out of phase. Two, or complimentary, phases each conduct 180 degrees out of phase through the same output choke assembly.

The Chopper Control Board, located on the Switch Board, receives welding output commands from the Control Board. The Chopper Control Board then determines the on-time of the six chopper IGBTs to meet the requirements set forth from the Control Board.

The Control Board receives commands and feedback information, via Arc-Link communication, from the optional User Interface Board, the Arc Link Receptacle, the Remote Control Board and the Chopper Control Board. It also receives output current and voltage information from the Current Transducer and via leads 202 and 206 from the output terminals.

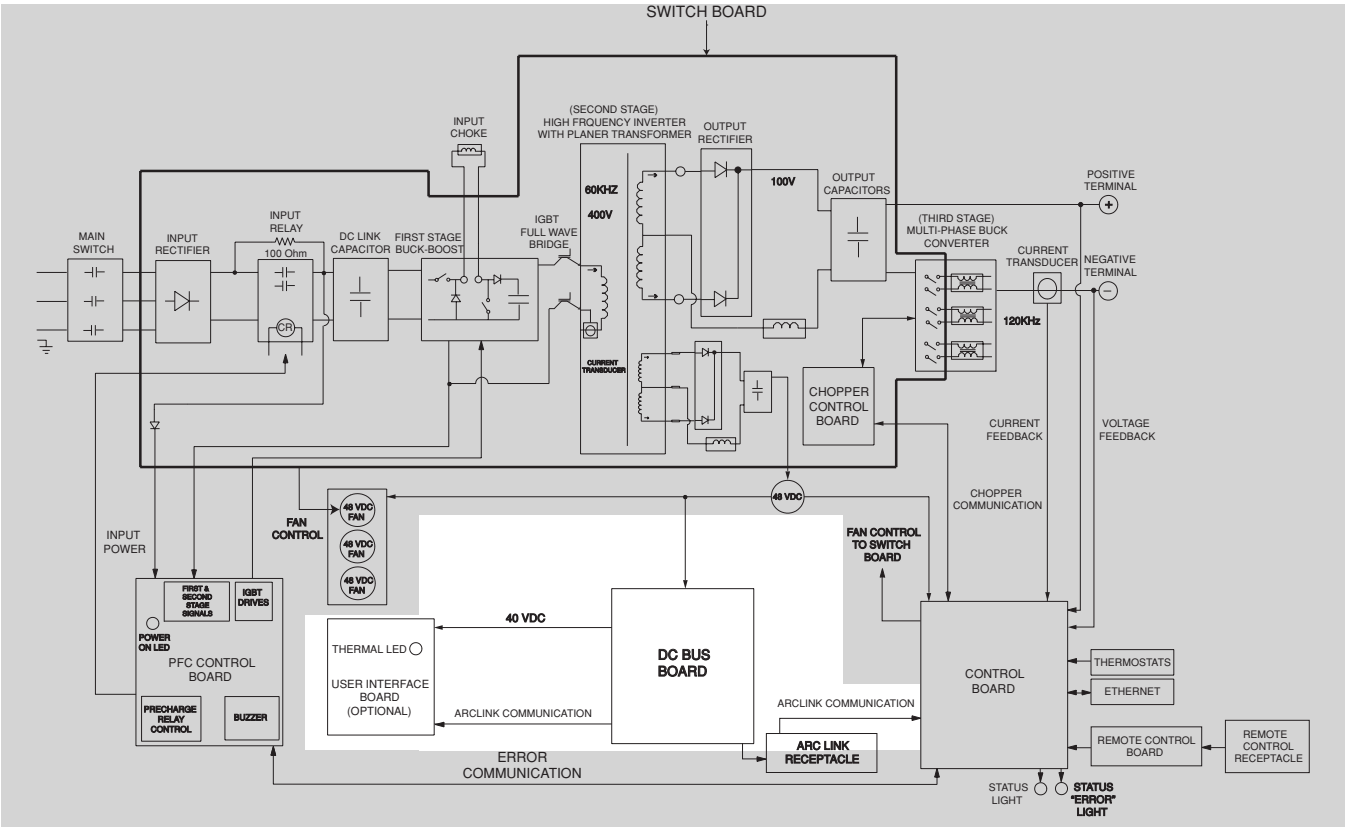
The Current Transducer monitors the output current and converts that information into a low voltage signal that is sent to the Control Board. (500 Amps = 4.0VDC). The Control Board uses this current feedback information along with the output voltage feedback to monitor and control the output of the machine. The control board also houses the software welding tables.

In addition, the Control Board monitors the thermostat circuitry, the shutdown circuitry and controls the two speed fans.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

Return to Section TOC
Return to Master TOC

FIGURE E.6 - DC BUS BOARD AND OPTIONAL USER INTERFACE BOARD



DC BUS BOARD AND OPTIONAL USER INTERFACE BOARD

The DC Bus Board receives 48VDC supply voltage from the Planar Transformer circuitry. This voltage is regulated to 40VDC and is applied to the ArcLink Receptacle for wire feeder operation.

The optional User Interface Board receives the operator commands, and via ArcLink communications, sends the appropriate signals to the Control Board.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

Return to Section TOC
Return to Master TOC

Machine Protection

THERMAL PROTECTION

Two normally closed (NC) thermostats protect the machine from excessive operating temperatures. One is connected to the control board. It is located on top of the secondary heat sink. The other thermostat is located and integrated into the switch board and is monitored by the Power Factor Correction Board. Excessive temperatures may be caused by a lack of cooling air or by operating the machine beyond its duty cycle or output rating. If excessive operating temperatures should occur, the thermostats will prevent output from the machine. The yellow thermal light, located on the front of the machine, will be illuminated. The thermostats are self-resetting once the machine cools sufficiently. If the thermostat shutdown was caused by excessive output or duty cycle and the fans are operating normally, the power switch may be left on and the reset should occur within a 15-minute period. If the fans are not turning or the intake air louvers are obstructed, the power must be removed from the machine and the fan condition or air obstruction corrected.

PROTECTIVE CIRCUITS

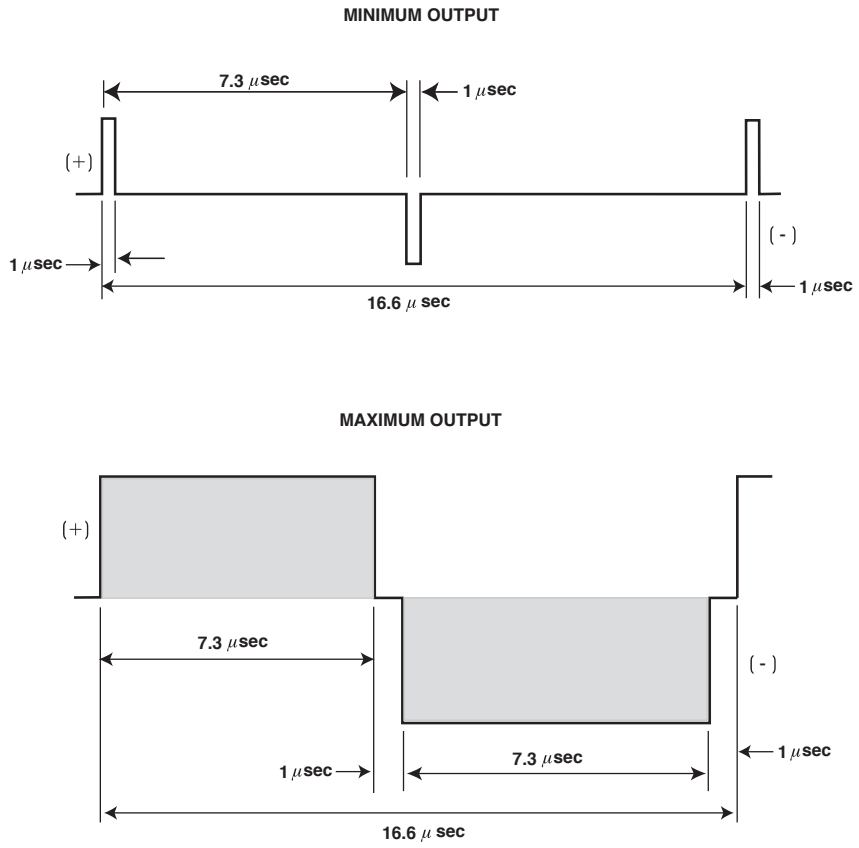
Protective circuits are designed into the Power Wave S350 to sense trouble and shut down the machine before damage occurs to the machine's internal components. Error Codes will be flashed out by the light on the Control Board and will help identify the reason for the shutdown. They should all be steady green. See the Troubleshooting Section for more information regarding Error Codes. Fault codes can also be seen by using the Diagnostic Software.

OVER CURRENT PROTECTION

If the average weld current exceeds 400 amps the machine's output will be disabled.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

FIGURE E.7 - IGBT OPERATION



PULSE WIDTH MODULATION

The term PULSE WIDTH MODULATION (PWM) is used to describe how much time is devoted to conduction in the positive and negative portions of the cycle. Changing the pulse width is known as MODULATION. Pulse Width Modulation is the varying of the pulse width over the allowed range of a cycle to affect the output of the machine.

MINIMUM OUTPUT

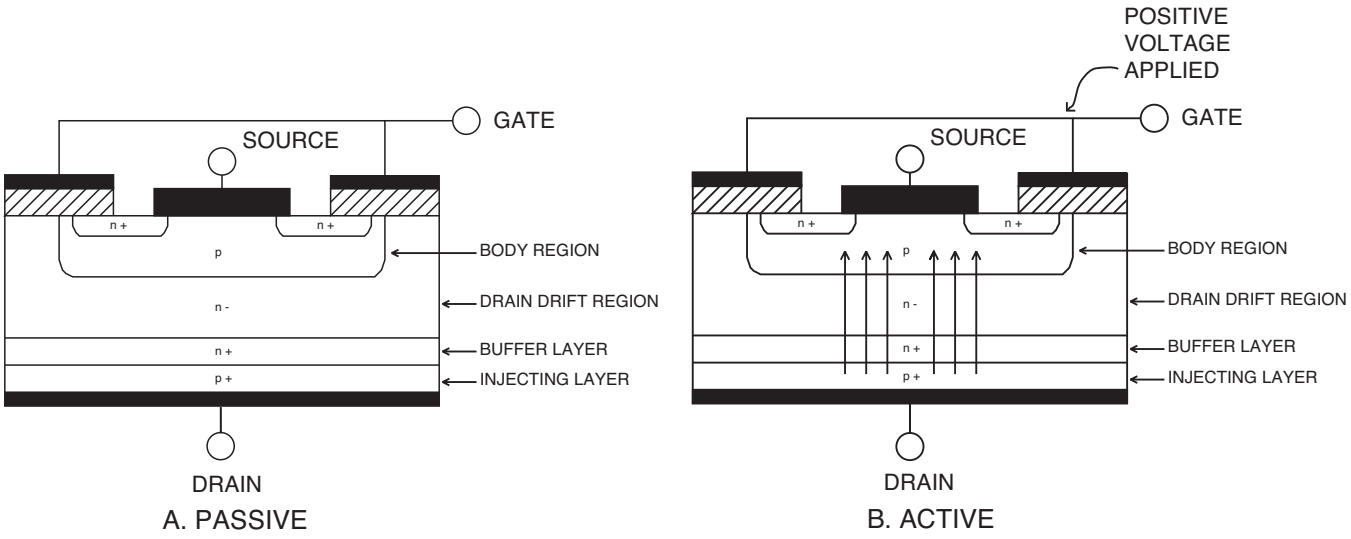
By controlling the duration of the gate signal, the IGBT is turned on and off for different durations during a cycle. The top drawing shows the minimum output signal possible over a 16.6-microsecond time period. The shaded portion of the signal represents one IGBT group1, conducting for 1 microsecond. The negative portion is the other IGBT group. The dwell time (off time) is 14.6 microseconds (both IGBT groups off). Since only 2 microseconds of the 16.6-microsecond time period are devoted to conducting, the output power is minimized.

MAXIMUM OUTPUT

By holding the gate signals on for 7.3 microseconds each and allowing only 2 microseconds of dwell or off time (one microsecond during each half cycle) during the 16.6 microsecond cycle, the output is maximized. The darkened area under the minimum output curve can be compared to the area under the maximum output curve. The more darkened area, the more power is present.

Return to Section TOC
Return to Master TOC

FIGURE E.8 - IGBT OPERATION



INSULATED GATE BIPOLAR TRANSISTOR (IGBT) OPERATION

An IGBT is a type of transistor. IGBTs are semiconductors well suited for high frequency switching and high current applications.

Drawing A shows an IGBT in a passive mode. There is no gate signal, (zero volts relative to the source), and therefore, no current flow. The drain terminal of the IGBT may be connected to a voltage supply; but since there is no conduction, the circuit will not supply current to components connected to the source. The circuit is turned off like a light switch in the OFF position.

Drawing B shows the IGBT in an active mode. When the gate signal, a positive DC voltage relative to the source, is applied to the gate terminal of the IGBT, it is capable of conducting current. A voltage supply connected to the drain terminal will allow the IGBT to conduct and supply current to circuit components coupled to the source. Current will flow through the conducting IGBT to downstream components as long as the positive gate signal is present. This is similar to
turning ON a light switch.

Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

TABLE OF CONTENTS - TROUBLESHOOTING AND REPAIR

Troubleshooting and Repair **F-1**

How to Use Troubleshooting Guide F-2

PC Board Troubleshooting Procedures F-3

Troubleshooting Guide F-4/F-12

Test Procedures F-13

Case Cover Removal and DC Link Capacitor Discharge Procedure F-13

Control Board Test F-17

Switch Board Test F-23

Power Factor Control Board Test F-31

Current & Voltage Calibration F-39

Optional User Interface Board F-43

Input Rectifier Test F-49

Planar Transformer Resistance Test F-53

Output Rectifier Test F-57

Current Transducer Test F-59

DC Bus Board Test F-65

Removal and Replacement Procedures F-69

Power Factor Correction Control Board F-69

Current Transducer (LEM) F-71

Control Board F-73

Switch Board Assembly F-77

DC Bus Board F-81

Remote PC Board F-85

Retest After Repair F-89

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

Service and Repair should only be performed by Lincoln Electric Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions detailed throughout this manual.

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

Step 1. LOCATE PROBLEM (SYMPTOM).
Look under the column labeled "PROBLEM (SYMPTOMS)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into the following categories: output problems, welding problems and ethernet problems.

Step 2. PERFORM EXTERNAL TESTS.
The second column labeled "POSSIBLE AREAS OF MISADJUSTMENT(S)" lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case wrap-around cover.

Step 3. RECOMMENDED COURSE OF ACTION
The last column labeled "Recommended Course of Action" lists the most likely components that may have failed in your machine. It also specifies the appropriate test procedure to verify that the subject component is either good or bad. If there are a number of possible components, check the components in the order listed to eliminate one possibility at a time until you locate the cause of your problem.

All of the referenced test procedures referred to in the Troubleshooting Guide are described in detail at the end of this chapter. Refer to the Troubleshooting and Repair Table of Contents to locate each specific Test Procedure. All of the specified test points, components, terminal strips, etc. can be found on the referenced electrical wiring diagrams and schematics. Refer to the Electrical Diagrams Section Table of Contents to locate the appropriate diagram.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

PC BOARD TROUBLESHOOTING PROCEDURES

⚠ WARNING

ELECTRIC SHOCK can kill.

- Have an electrician install and service this equipment. Turn the input power OFF at the fuse box before working on equipment. Do not touch electrically hot parts.

⚠ CAUTION

Sometimes machine failures appear to be due to PC board failures. These problems can sometimes be traced to poor electrical connections. To avoid problems when troubleshooting and replacing PC boards, please use the following procedure:

1. Determine to the best of your technical ability that the PC board is the most likely component causing the failure symptom.
2. Check for loose connections at the PC board to assure that the PC board is properly connected.
3. If the problem persists, replace the suspect PC board using standard practices to avoid static electrical damage and electrical shock. Read the warning inside the static resistant bag and perform the following procedures:

PC board can be damaged by static electricity.

ATTENTION Static-Sensitive Devices Handle only at Static-Safe Workstations

- Remove your body's static charge before opening the static-shielding bag. Wear an anti-static wrist strap. For safety, use a 1 Meg ohm resistive cord connected to a grounded part of the equipment frame.

- If you don't have a wrist strap, touch an un-painted, grounded, part of the equipment frame. Keep touching the frame to prevent static build-up. Be sure not to touch any electrically live parts at the same time.

- Tools which come in contact with the PC board must be either conductive, anti-static or static-dissipative.

- Remove the PC board from the static-shielding bag and place it directly into the equipment. Don't set the PC board on or near paper, plastic or cloth which could have a static charge. If the PC board can't be installed immediately, put it back in the static-shielding bag.

- If the PC board uses protective shorting jumpers, don't remove them until installation is complete.

- If you return a PC board to The Lincoln Electric Company for credit, it must be in the static-shielding bag. This will prevent further damage and allow proper failure analysis.

4. Test the machine to determine if the failure symptom has been corrected by the replacement PC board.

NOTE: It is desirable to have a spare (known good) PC board available for PC board troubleshooting.

NOTE: Allow the machine to heat up so that all electrical components can reach their operating temperature.

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.
   a. If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks, and terminal strips.
   b. If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.
6. Always indicate that this procedure was followed when warranty reports are to be submitted.

NOTE: Following this procedure and writing on the warranty report, "INSTALLED AND SWITCHED PC BOARDS TO VERIFY PROBLEM," will help avoid denial of legitimate PC board warranty claims.

Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Major physical or electrical damage is evident when the S350 case is removed.	Contact your local authorized Lincoln Electric Service Facility.	Contact the Lincoln Electric Service Department at 1-888-935-3877.
The input fuses repeatedly fail or the input circuit breakers keep tripping.	Make certain the fuses or breakers are properly sized. The welding procedure may be drawing too much input current or the duty cycle may be too high. Reduce the welding current and/or reduce the duty cycle. Check for error codes. See ***Status LED Troubleshooting*** in this section.	Perform the ***Input Rectifier Test***. Perform the ***Switch Board Test***. Perform the ***PFC Control Board Test***.
The machine will not power up. – no lights or displays-. The machine appears to be off.	Make sure the proper input voltage is being applied to the machine.(check fuses or breakers) Make sure the input supply disconnect has been turned ON. Make certain the input power switch (SW1) is in the ON position. Check for error codes. See ***Status LED Troubleshooting*** in this section.	Check the input switch SW1 for proper operation. Also check the associated leads for loose or faulty connections. See the Wiring Diagram. Check to make sure that 40VDC is being applied to the optional User Interface Board at leads 52D(+) to lead 51D(-). See the wiring diagram. Perform the ***DC Bus Board Test***. Perform the ***Input Rectifier Test***. Perform the ***PFC Control Board Test***.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The POWER WAVE S350 does not have welding output.	Make sure the input voltage is correct. If the symptom is accompanied by an error code see the ***Status LED Troubleshooting section***. There may be an external "short" in the external output circuitry. Remove all loads from the output terminals and restart the machine. Make sure the wire feeder gun trigger circuit is functioning properly. When the gun trigger is activated the fans should go to high speed. If the thermal LED is lit the unit may be overheated. Adjust the welding load and /or duty cycle to coincide with the output limits of the PW S350. Also see the symptom "The Thermal LED is ON" in this section.	Perform the ***Input Rectifier Test.*** Perform the ***Switch Board Test.*** Perform the ***Planar Transformer Resistance Test.*** Perform the ***Control Board Test.*** Perform the ***Optional User Interface Board Test.*** Perform the ***Output Rectifier Test.*** Perform the ***DC Bus Board Test.***
The Thermal LED is ON. The machine regularly overheats. There is no welding output.	The welding application may be exceeding the recommended duty cycle and/or current limits of the machine. Dirt and dust may have clogged the cooling channels inside the machine. Refer to the ***Maintenance Section*** of this manual. The air intake and exhaust louvers may be blocked due to inadequate clearance around the machine. Make sure the fans are functioning correctly. The fans should run in a low speed setting when the machine is at idle and in a high speed when welding output is activated. The fans should also run if a thermostat has tripped.	Check the thermostats and associated wiring for loose or faulty connections. See the wiring diagram. Check the DC voltages being applied to the fans at lead 351 (-) to lead 353 (+). At the low speed setting the voltage should be 24VDC. At the high speed setting the voltage should be 48VDC. See the wiring diagram.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The "Real Time Clock" no longer functions.	The Control Board Battery may be faulty. Replace if necessary. (Type BS2032)	The Control Board may be faulty.
The S350 will not produce full output.	The input voltage may be too low. See the Check for error codes. See ***Status LED Troubleshooting*** in this section. Make certain the input voltage is correct for the machine.	Perform the ***Current Transducer Test.*** Perform the ***Current and Voltage Calibration Procedure.*** The Control Board may be faulty. Perform the ***Control Board Test.***

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
WELDING PROBLEMS		
General degradation of the welding performance.	Check for proper wire feeding. Make certain that the actual speed is the same as the preset. Verify that the correct wire drive and gear ratio have been selected. Check the welding cables for loose or faulty connections. Check for adequate gas shielding. Make sure the welding process is correct for the wire feed and voltage settings.	Perform the ***Current and Voltage Calibration Procedure.***
The wire burns back to the tip at the end of the weld.	Reduce the burnback time. Reduce the workpoint.	N/A
During a weld the machine shuts down.	The secondary current limit has been exceeded and the machine shuts down to protect itself. Adjust the procedure to reduce the load and lower the output current draw.	A non-recoverable internal fault will interrupt the welding output. This condition will also result in a status light blinking. Check for error codes. See ***Status LED Troubleshooting*** in this section.
The arc is excessively long and erratic.	In the wire feeder, make certain the correct wire drive and gear ratio have been selected for the welding process being used. Make sure the shielding gas is correct for the welding process being used. Also make sure the flow rate is correct.	Perform the ***Current and Voltage Calibration Procedure.***

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
WELDING PROBLEMS		
The welding starting is poor.	Make sure the driver roll tension on the wire feeder is adjusted correctly. Also the welding wire should travel freely through wire feeding path. Check the welding tip for blockage.	

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ETHERNET PROBLEMS		
The system will not connect.	Make sure that the correct patch cable or cross over cable is being used. Make sure the software is not blocking the connection. See the on line Diagnostic Utility. Verify that the cables are fully inserted into the bulk head connector. Verify that the network device connected to the Power Wave is either a 10-baseT device or a 10/100-baseT device. The LED located under the PC board Ethernet connector will be lit when the machine is connected to another network device.	Use Weld Manager (included on the Power Wave Utilities and Service Navigator CD's or available at ***www.powerwavesoftware.com***) to verify the correct IP address information has been entered. Verify that no duplicate IP addresses exist on the network.
The Ethernet connection drops out while welding.	Make sure all of the connections are tight and secure.	Make certain that the network cable is not located next to any heavy current carrying conductors. This would include input power cables and welding output cables.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

USING THE STATUS LED TO TROUBLESHOOT SYSTEM PROBLEMS

Not all of the Power Wave® S350CE errors will be displayed on the user interface (if it is installed). There are two status lights that display error codes. If a problem occurs it is important to note the condition of the status lights. **Therefore, prior to cycling power to the system, check the power source status light for error sequences as noted below.**

There is one externally mounted status lights located on the case front of the machine. This status light corresponds to the main control board's status. A second status light is internal and is located on the input control board and can be seen by looking through the left case side louvers.

There is an audible beeper associated with this input control board's status light. So the error codes on the input board can be detected through either the status light or the status beeper.

Included in this section is information about the Status Lights and some basic troubleshooting charts for both machine and weld performance.

The status lights for the main control board is a dual-color LED's. Normal operation for each is steady green. Where as the status light on the input control board is one color. Normal operation is for the status light to be off (and the buzzer to be off).

Error conditions are indicated in the following chart Table F.1.

TABLE F.1

Light Condition	Meaning	
	Main control board status light	**Input control board**
Steady Green	System OK. Power source is operational, and is communicating normally with all healthy peripheral equipment connected to its ArcLink network.	Not applicable.
Blinking Green	Occurs during power up or a system reset, and indicates the POWER WAVE® S350 is mapping (identifying) each component in the system. Normal for first 1-10 seconds after power is turned on, or if the system configuration is changed during operation.	Not applicable.
Fast Blinking Green	Indicates Auto-mapping has failed	Not applicable.
Alternating Green and Red	Non-recoverable system fault. If the Status lights are flashing any combination of red and green, errors are present. **Read the error code(s) before the machine is turned off.**	Not applicable.
	Error Code interpretation through the Status light is detailed in the Service Manual. Individual code digits are flashed in red with a long pause between digits. If more than one code is present, the codes will be separated by a green light. Only active error conditions will be accessible through the Status Light.	
	Error codes can also be retrieved with the **Diagnostics Utility** (refered to on the **Service Navigator** DVD or available at **www.powerwavesoftware.com**). This is the preferred method, since it can access historical information contained in the error logs.	
	To clear the active error(s), turn power source off, and back on to reset.	
Steady Red	Not applicable.	Not applicable.
Blinking Red	Not applicable.	**Error Code interpretation -** Individual code digits are flashed in red with a long pause between digits. These error codes are three digit codes that all start with a number three.
Status LED off	Not applicable.	System OK

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Observe Safety Guidelines detailed in the beginning of this manual.

ERROR CODES FOR THE POWER WAVE® S350

The following is a list of possible error codes for the POWER WAVE® S350.

MAIN CONTROL BOARD ("STATUS" LIGHT)	
Error Code #	**Indication**
36 Thermal error	Indicates over temperature. Usually accompanied by Thermal LED. Check fan operation. Be sure process does not exceed duty cycle limit of the machine
54 Secondary (Output) over current error	The long term average secondary (weld) current limit has been exceeded. **NOTE:** The long term average secondary current limit is 325 amps.
56 Chopper communication error	Indicates communication link between main control board and chopper has errors. If cycling the input power on the machine does not clear the error, contact the Service Department.
58 Primary Fault error	Review error code from input board status light or status beeper. Most likely caused by an over power condition which caused an under voltage on the primary bus. If cycling the input power on the machine does not clear the error, contact the Service Department.
Other	Error codes that contain three or four digits are defined as fatal errors. These codes generally indicate internal errors on the Power Source Control Board. If cycling the input power on the machine does not clear the error, contact the Service Department.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Observe Safety Guidelines detailed in the beginning of this manual.

INPUT CONTROL BOARD

Error Code #	Indication
331 Peak input current limit	Input current limit has been exceeded. Typically indicates short term power overload. If problem persists contact Service Department.
333 Under-voltage lockout	+15 VDC supply on Input control board too low. Verify input voltage is within the acceptable range. If problem persists contact service department.
336 Thermal Fault	Thermostat on primary module tripped. Typically caused by bottom fan not working.
337 Pre-charge timeout	Problem with start-up sequence. If problem persists contact Service Department.
346 Transformer primary over current	Transformer current too high. Typically indicates short term power overload. If problem persists contact service department.
Other	Contact the Service Department.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
Return to Master TOC

CASE COVER REMOVAL AND DC LINK CAPACITOR DISCHARGE PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the case sheet metal cover and discharging the DC link capacitor making it safe for the technician to work on the machine.

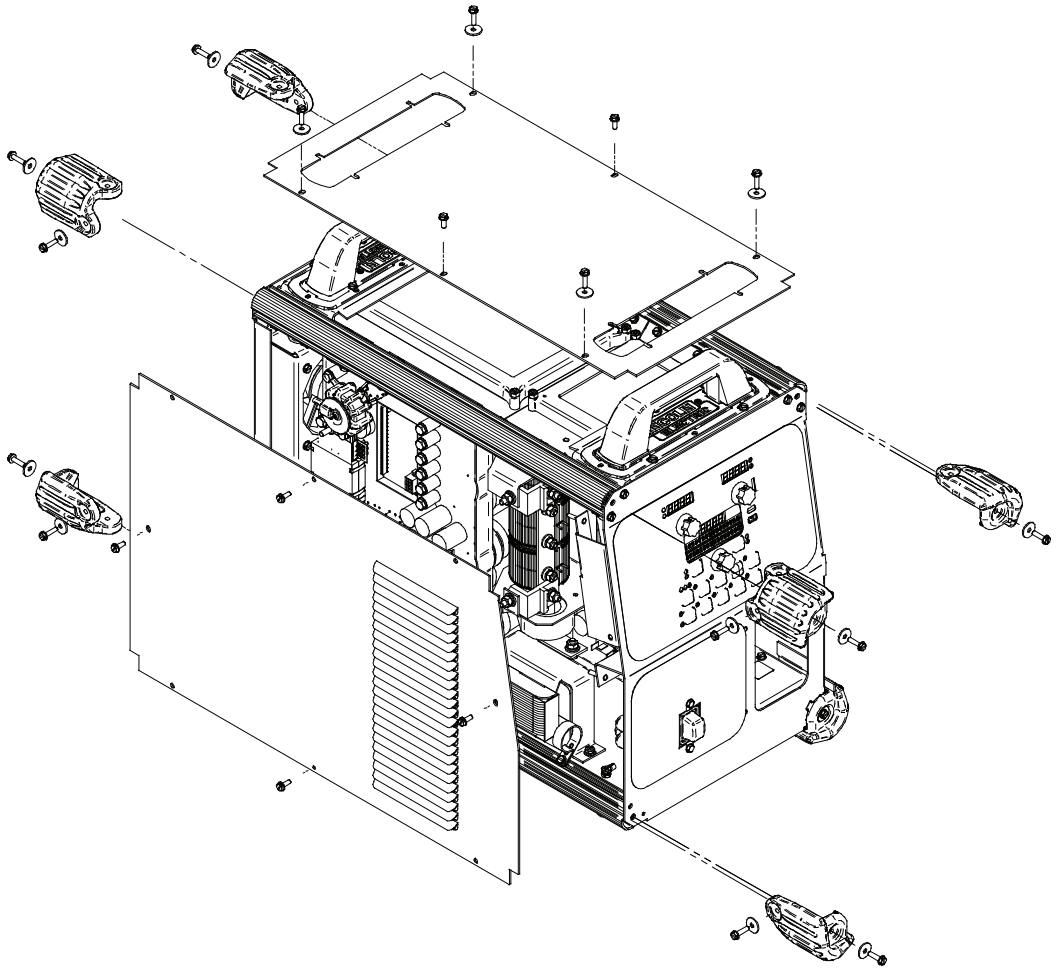
MATERIALS NEEDED

5/16 Inch Nut Driver
25-1000 Ohm resistor (25 Watts minimum)

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CASE COVER REMOVAL AND DC LINK CAPACITOR DISCHARGE PROCEDURE (continued)

FIGURE F.1 – CASE COVER SCREW LOCATION



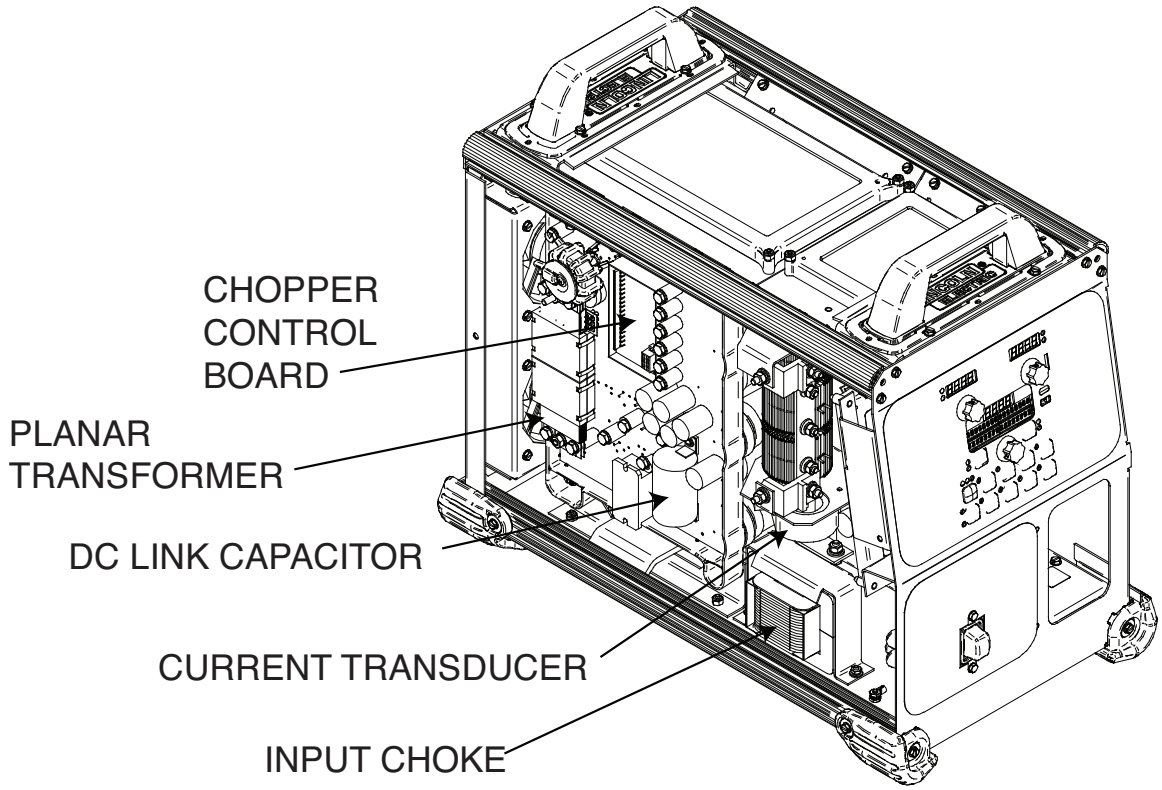
PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. Using the 5/16 inch nut driver remove the four (top) corner end caps as shown in Figure F.1. Keep the screws and flat washers for reassembly.
3. To gain access to the left side internal components use the 5/16 inch nut driver to remove the six remaining screws from the left side. See Figure F.1.
4. Locate the DC Link Capacitor and carefully check the voltage across it. ***See Figure F.2.*** If any voltage is present discharge the capacitor using the high wattage resistor (25-1000 ohms @ 25 watts minimum), electrically insulated gloves and pliers. Hold on the resistor terminals on the capacitor terminals for 10 seconds.
5. Recheck the voltage across the capacitor terminals. The voltage should be zero. If any voltage remains repeat the procedure. Note. Any voltage present after discharge has been performed is an abnormal condition and may indicate a switch board problem.
6. To gain access to the right side portion of the unit remove the six remaining screws from the right cover.
7. When replacing the case side and/or top be sure to secure all screws.
8. When replacing the corner end caps be certain to replace the flats washers previously removed.

Return to Section TOC
Return to Master TOC

CASE COVER REMOVAL AND DC LINK CAPACITOR DISCHARGE PROCEDURE (continued)

FIGURE F.2 – CAPACITOR LOCATION



CAPACITOR DISCHARGE PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. Be careful not to make contact with capacitor terminals located on the left side of chassis as shown in Figure F.2.
3. Carefully check for DC voltage at the capacitor terminals. ***See Figure F.3.***
4. If the capacitor voltage is present discharge the capacitor as follows.
5. Using a high wattage resistor (25-1000 ohms @ 25 watts (minimum), electrically insulated gloves and pliers hold the resistor terminals across the capacitor terminals for 10 seconds

⚠ WARNING

ELECTRIC SHOCK can kill.

High voltage is present when input power is applied to the machine.

DO NOT TOUCH THE CAPACITOR TERMINALS WITH YOUR BARE HANDS.

NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.

6. Recheck the voltage across the capacitor terminals. The voltage should be zero. If any voltage remains, repeat the procedure. NOTE: Any voltage present after discharge has been performed is an abnormal condition and may indicate a switch board problem.

Return to Section TOC
Return to Master TOC

CASE COVER REMOVAL AND DC LINK CAPACITOR DISCHARGE PROCEDURE (continued)

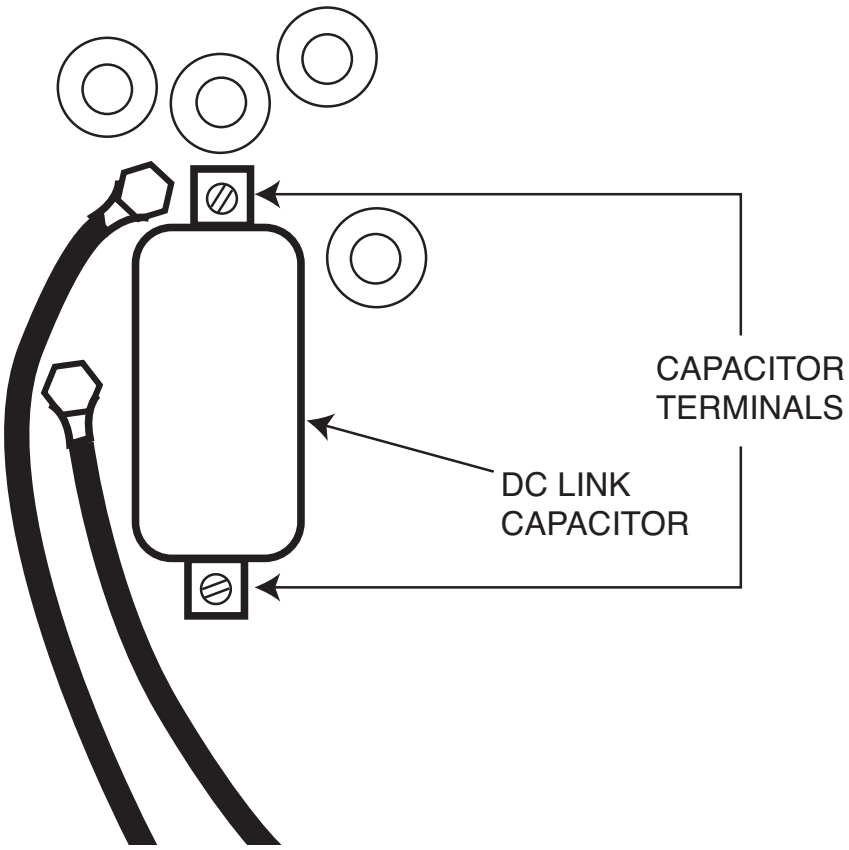
⚠ WARNING

ELECTRIC SHOCK can kill.

High voltage is present when input power is applied to the machine.

7. **Also carefully check for a DC Voltage at B48 - B49. *See Figure F.9*. If a voltage is present wait for it to decay before proceeding.**

FIGURE F.3 – CAPACITOR TERMINALS AND ASSOCIATED LEADS



Return to Section TOC
Return to Master TOC

CONTROL BOARD TEST PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will help determine if the Control Board is receiving the correct supply voltages and creating the correct output voltages to various circuits. Also the LED's status chart will provide information as to the Control Board's functionality.

MATERIALS NEEDED

Voltmeter/Ohmmeter (Multimeter)

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CONTROL BOARD TEST PROCEDURE (continued)

TABLE F.2 – CONTROL BOARD VOLTAGE TESTS

Description	Test Points	Leads Numbers	Expected Reading	Conditions
Input Supply to Board	J4 pin 2 To J4 pin 1	Lead 356 (-) To Lead 358 (+)	48 VDC	Input power applied to machine
Power from control board to chopper board	J12 pin 12 To J12 pin 3	Lead 342 (-) To Lead 341 (+)	5 VDC	Input power applied to machine
Secondary voltage from PFC board	J6 pin 10 To J7 pin 14	Lead 404 (-) To Lead 406 (+)	15 VDC	Input power applied to machine
Fan control signal	J7 pin 16 To J7 pin 6	Lead 350 (-) To Lead 355 (+)	0 VDC (Low Speed) 10 VDC (High Speed)	Input power applied. Output enabled for high fan speed signal
Power supply to Current Transducer	J8 pin 6 To J8 pin 2	Lead 214 (-) To Lead 212 (+)	+15 VDC	Input power applied to machine
Power supply to Current Transducer	J8 pin 6 To J8 pin 3	Lead 214 (-) To Lead 213 (+)	-15 VDC	Input power applied to machine

PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. Perform the ***Case Cover and DC Link Capacitor Discharge Procedure.***
3. Locate the control board on the right side of the machine.
4. Carefully apply the correct input voltage to the Power Wave S350 machine.
5. ***See Figure F.4*** for LEDs status and functions. If Led #9 is green the proper input voltage is being applied to the control board. If LED #1 is green the control board's functioning status is "OK".
6. If further testing is required proceed to Step #7.
7. Using the Voltmeter carefully check the voltages per Table F.2. ***See Figure F.5*** for test point locations and ***Figure F.6*** for lead locations.
8. Using the Ohmmeter check the resistances per ***Table F.3. See Figure F.5*** for test point locations and ***Figure F.6*** for lead locations.

Return to Section TOC
Return to Master TOC

CONTROL BOARD TEST PROCEDURE (continued)

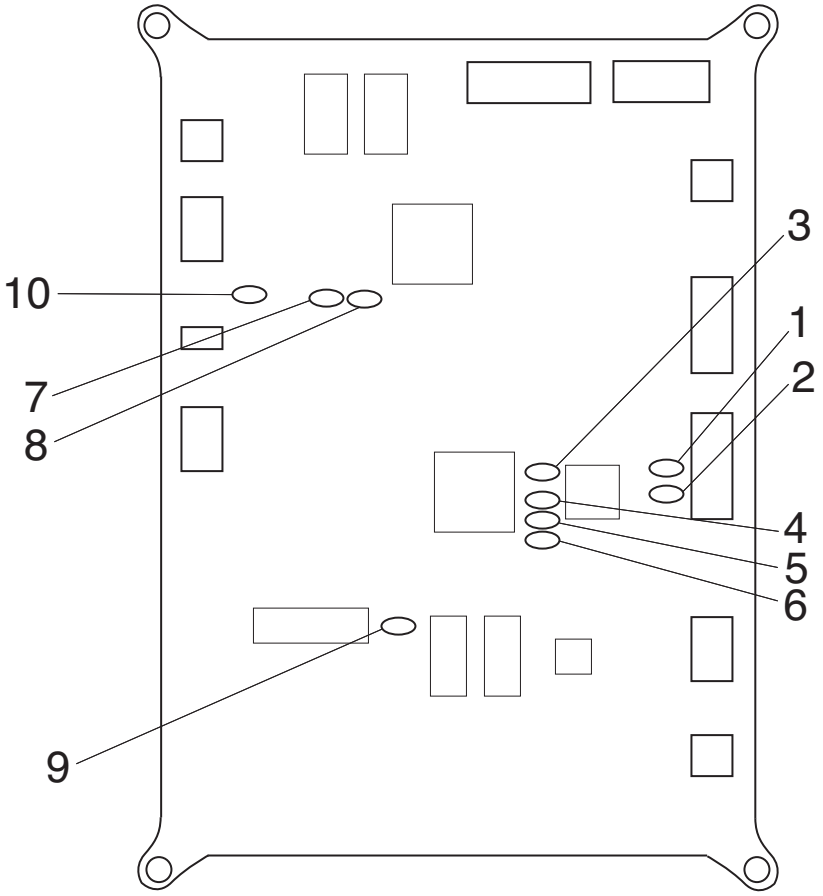
TABLE F.3 - CONTROL BOARD ASSOCIATED RESISTANCE

Description	Test Points	Leads Numbers	Expected Reading	Conditions
Connection to Output Terminals	J9 pin 3 To Negative Output Terminal	Lead 202 To Negative Output Terminal	Zero Ohms	No Input power applied to machine
	J9 pin 1 To Positive Output Terminal	Lead 206 To Positive Output Terminal	Zero Ohms	
Connections to Normally Closed Thermostats	J5 pin 2 To J5 pin 3	Lead 410 To Lead 409	Zero Ohms	No Input power applied to machine

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CONTROL BOARD TEST PROCEDURE (continued)

FIGURE F.4 – LED LOCATIONS

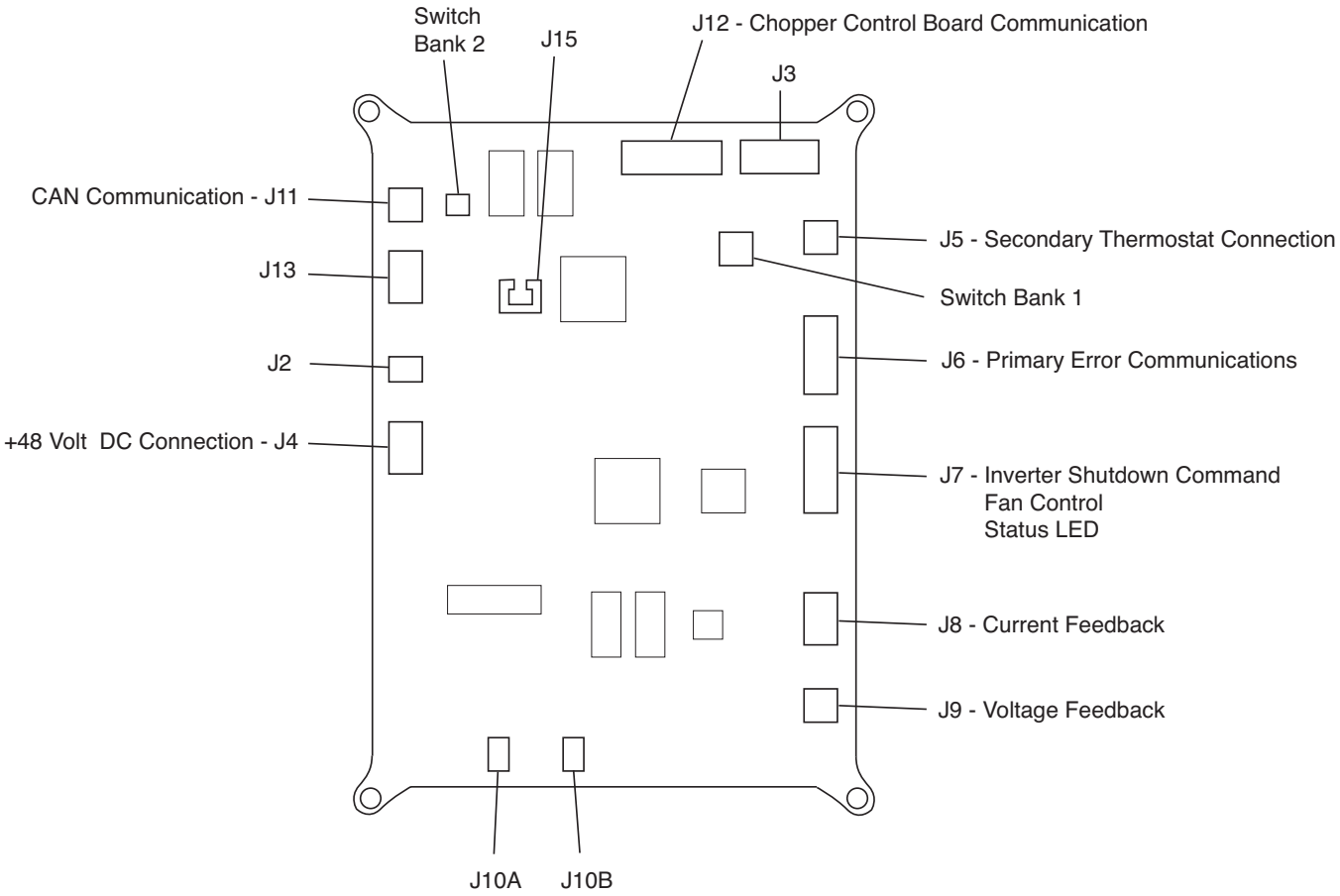


G4800 CONTROL P.C. BOARD		
LED #	COLOR	FUNCTION
1	GREEN	STATUS "OK"
2	RED	STATUS "ERROR" (CHECK CODE FOR SPECIFIC ERROR)
3	GREEN	OUTPUT ENABLE
4	GREEN	SINGLE PHASE DETECT
5	GREEN	67 SENSE
6	GREEN	21 SENSE
7	GREEN	ETHERNET STATUS
8	GREEN	ETHERNET STATUS
9	GREEN	INPUT SUPPLY 30 VDC TO 55 VDC
10	GREEN	DEVICENET

Return to Section TOC
Return to Master TOC

CONTROL BOARD TEST PROCEDURE (continued)

FIGURE F.5 – TEST POINT LOCATIONS

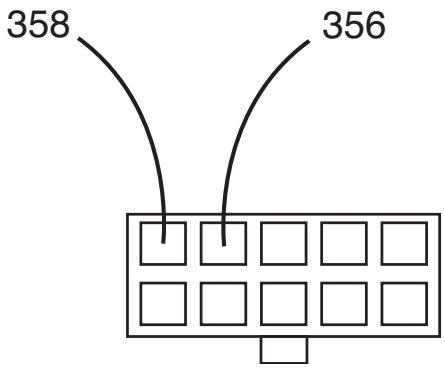


Return to Section TOC
Return to Master TOC

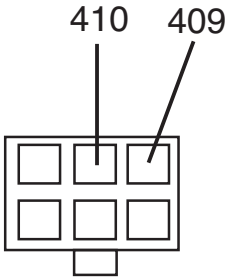
CONTROL BOARD TEST PROCEDURE (continued)

FIGURE F.6 – PLUGS & LEAD LOCATIONS

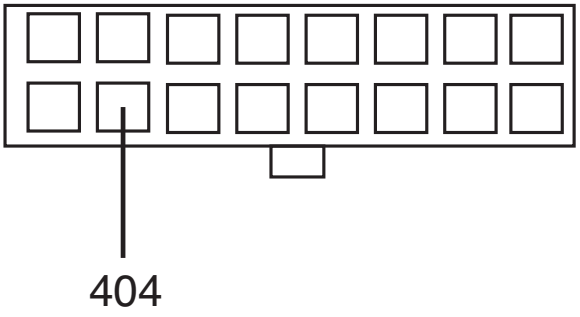
PLUG J4



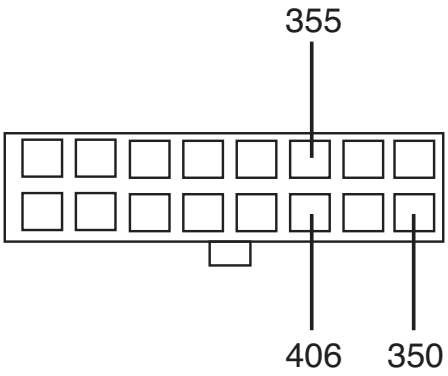
PLUG J5



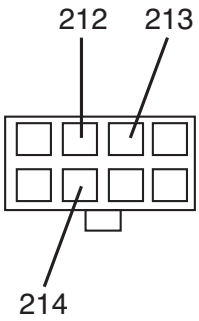
PLUG J6



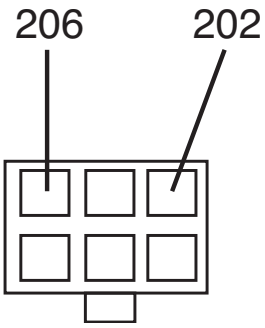
PLUG J7



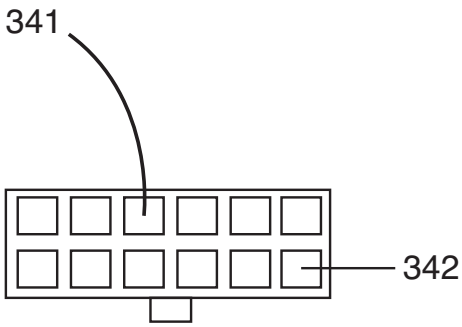
PLUG J8



PLUG J9



PLUG J12



Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SWITCH BOARD TEST PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will help determine if the Switch Board is receiving the correct voltages and also if the Switch Board is functioning properly. The Switch Board has many functions and components. Testing of the Planar Transformer, the Input Rectifier and the Output Diodes are addressed with individual testing procedures. See the ***"F"Section Table of Contents.***

MATERIALS NEEDED

Voltmeter/Ohmmeter (Multimeter)
7/16 Inch Wrench

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SWITCH BOARD TEST PROCEDURE (continued)

TABLE F.4 - SWITCH BOARD LED's

Description	Indicates	Light	Conditions
LED 1	+48VDC Supply	ON	Power applied to PW C300
LED 4	+15VDC Supply	ON	Power applied to PW C300
LED 3	Boost Circuit Active	ON*	*When high input voltage is applied (460 and higher) LED3 may be very dim or off
LED11	Buck Circuit Active	ON**	** Brilliance may vary with load
LEDs 5 thru 10	Chopper IGBTs activated	ON***	*** Brilliance will vary with load and output

PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. Perform the ***Case Cover and DC Link Capacitor Discharge Procedure.***

⚠ WARNING

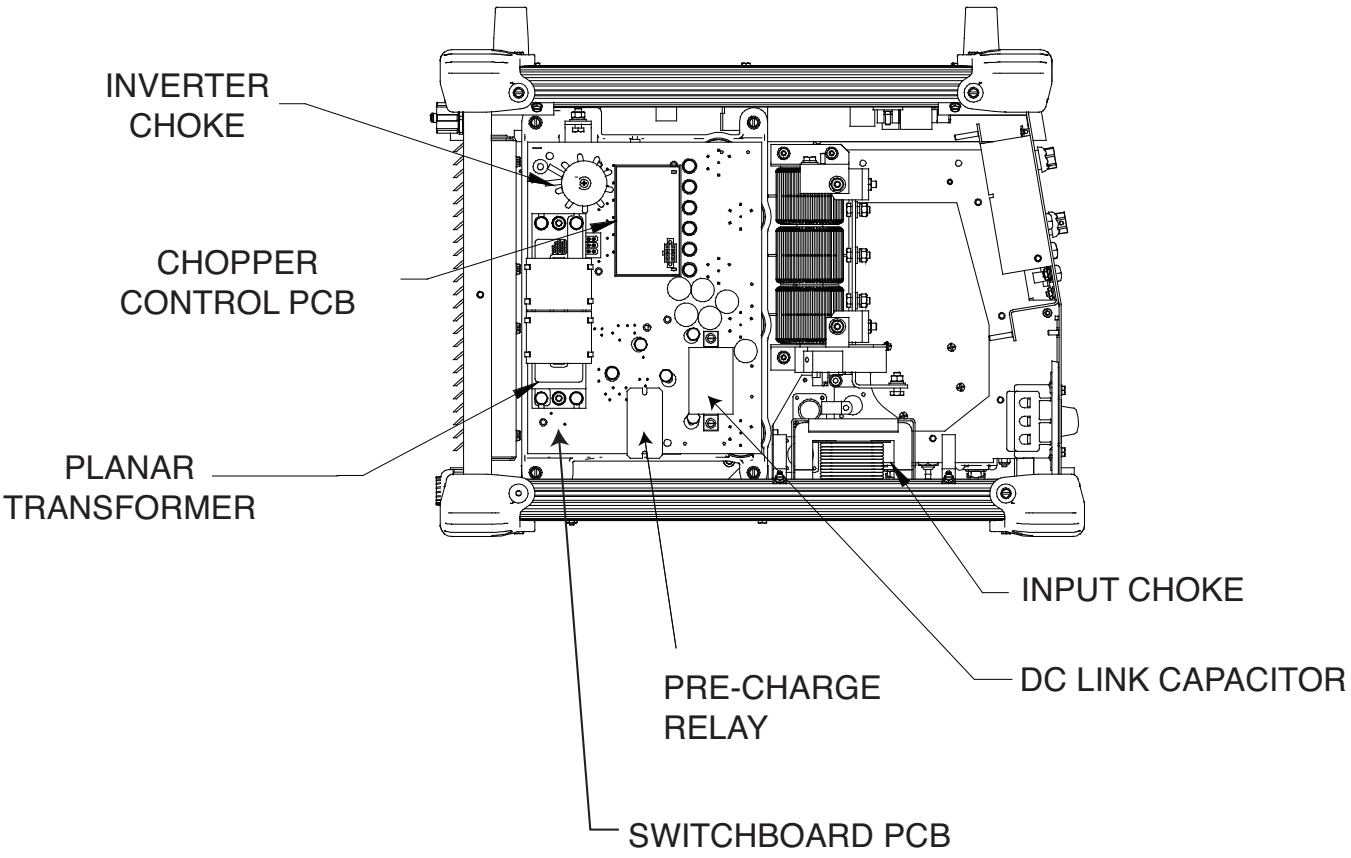
High voltages are present on and around the switch board. Take the appropriated safety precautions when performing the following procedures.

3. Locate the switch board on the left side of the machine. ***See Figure F.7***.
4. Carefully apply the correct input power to the Power Wave S350. Check the LEDs per Table F.4. ***See Figure F.8*** for LED locations.
5. If the LEDs are not indicating a properly functioning switch board (per Table F.4.) proceed with the following steps.
6. Check the voltages per ***Table F.5***. ***See Figure F.9*** for test point locations.
7. Check the switch board resistances per ***Table F.6. See Figure F.9*** for test point locations.
8. If any of the above tests are not correct the Switch should be replaced.
9. Replace all plugs and leads that were previously disconnected.
10. Replace the case covers.

Return to Section TOC
Return to Master TOC

SWITCH BOARD TEST PROCEDURE (continued)

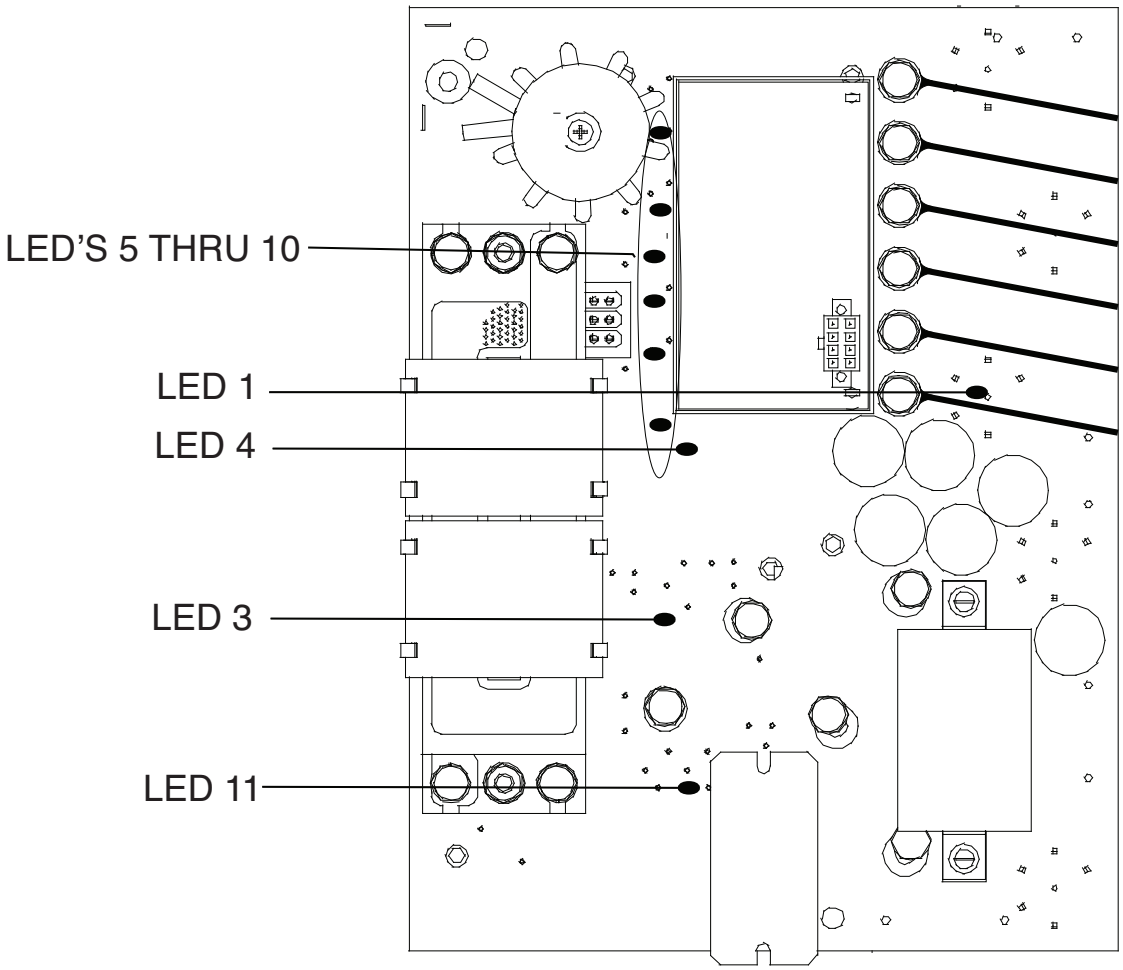
FIGURE F.7 - SWITCH BOARD LOCATION



Return to Section TOC
Return to Master TOC

SWITCH BOARD TEST PROCEDURE (continued)

FIGURE F.8 – SWITCH BOARD LED's



LED'S 5 Thru 10
These six LED's are used to indicate a turn-on of a chopper phase. Intensity of each LED is related to the on-time of each of the IGBT's

LED 4
+15 Volt DC power supply for secondary control circuits.

LED 1
+48 Volt DC auxiliary power supply indicator

LED 3
Boost IGBT drive.

LED 11
Buck IGBT drive.

Return to Section TOC
Return to Master TOC

SWITCH BOARD TEST PROCEDURE (continued)

TABLE F.5 – SWITCH BOARD VOLTAGE MEASUREMENTS

Description	Test Points	Expected Reading	Conditions
Pre-charge relay coil voltage	Plug J41 Pin 6(-) To Plug J41 Pin5(+)	15VDC	Correct input power applied to machine and pre-charge completed. If not correct the Perform the ***Power Factor Control Board Test***. See wiring diagam
400VDC from Buck/Boost and DC Link Capacitor	B48(+) To B49(-)	400VDC	Correct input power applied to machine and pre-charge completed. If not correct Perform the ***Input Rectifier Test***
48 VAC from the Planar Transformer Winding	B7 To B9 Also B7 to B8	50VAC	Correct input power applied to machine and pre-charge completed. If not correct Perform the ***Planar Transformer Test***
100VAC from Planar Transformer Winding	B38 To B40	100V AC	Correct input power applied to machine and pre-charge completed. If not correct Perform the ***Planar Transformer Test***
100VDC from Output Rectifier	B52(-) To B51(+)	100VDC	Correct input power applied to machine and pre-charge completed. If not correct Perform the ***Outpur Rectifier Test***

Return to Section TOC
Return to Master TOC

SWITCH BOARD TEST PROCEDURE (continued)

TABLE F.6 – SWITCH BOARD RESISTANCE MEASUREMENTS

Description	Meter Test Points and Polarity	Expected Readings	Conditions
100 Ohm Pre-Charge Resistor	B10(+) To B12(-)	100 Ohm	Machine “off” no input power applied
Pre-Charge Relay Coil Resistance	J41 Pin 5 (+) Receptacle on Switch Board To J41 Pin 6(-) Receptacle on Switch Board	15,000 to 30,000 ohms dependant on meter being used. Two diodes are in the circuit path to the relay coil.	Machine “off” no input power applied. Plug J41 removed from the Switch Board.
“Buck” Converter IGBTs	B12(+) To B28(-)	High Resistance Greater than 100,000 ohms Typical failure is a “short”	Machine “off” no input power applied. The Input Choke disconnected from the Switch Board B28.
“Buck” Converter Diode	B28(+) To B49(-)	High Resistance Greater than 100,000 ohms Typical failure is a “short”	Machine “off” no input power applied. The Input Choke disconnected from the Switch Board B28.
“Boost” Converter IGBTs	B29(+) To B49(-)	High Resistance Greater than 10,000 ohms Typical failure is a “short”	Machine “off” no input power applied. The Input Choke disconnected from the Switch Board B28.
“Boost” Converter Diode	B48(+) To B29(-)	High Resistance Greater than 10,000 ohms Typical failure is a “short”	Machine “off” no input power applied. The Input Choke disconnected from the Switch Board B28.
Full Bridge High Side IGBTs	B48(+) To B37(-) Also B48(+) To B41(-)	High Resistance Greater than 10,000 ohms Typical failure is a “short”	Machine “off” no input power applied. The Planar Transformer electrically isolated from the Swithc Board at test points B37 and B41.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SWITCH BOARD TEST PROCEDURE (continued)

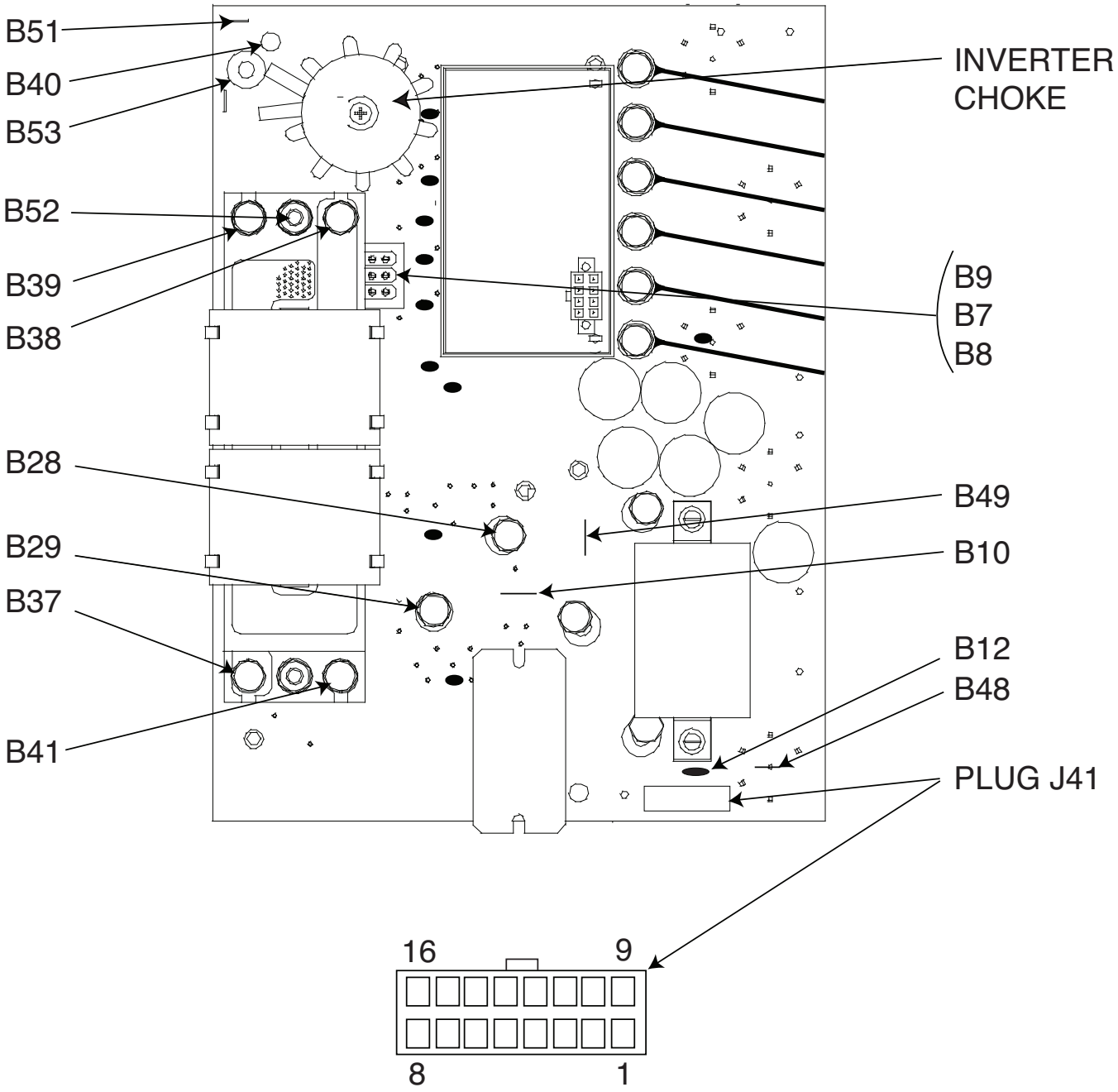
TABLE F.7 – SWITCH BOARD RESISTANCE MEASUREMENTS (continued)

Full Bridge Low Side IGBTs	B37(+) To B49(-) Also B41(+) To B49(-)	High Resistance Greater than 10,000 ohms Typical failure is a “short”	Machine “off” no input power applied. The Planar Transformer electrically isolated from the Switch Board at test points B37 and B41

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SWITCH BOARD TEST PROCEDURE (continued)

FIGURE F.9 – SWITCH BOARD TEST POINTS



Return to Section TOC
Return to Master TOC

POWER FACTOR CONTROL BOARD TEST PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will help determine if the Power Factor Correction Control Board is functioning correctly. There are very high voltages present on the PFC Control Board. This test will be limited to LED and audio error codes and also resistance checks with the input power removed from the machine.

MATERIALS NEEDED

Voltmeter/Ohmmeter (Multimeter)

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

POWER FACTOR CONTROL BOARD TEST PROCEDURE (continued)

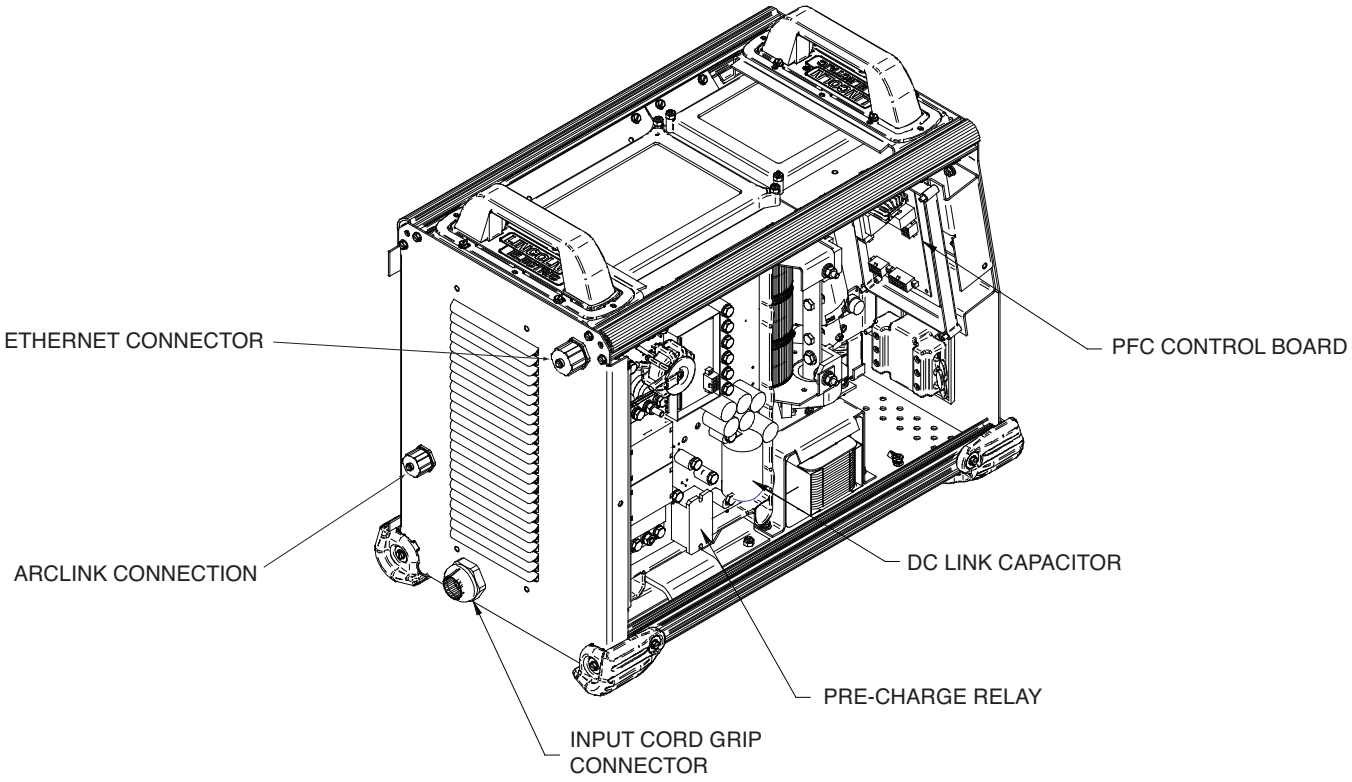
PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. Perform the ***Case Cover and DC Link Capacitor Discharge Procedure.***
3. Locate the PFC Control Board. ***See Figure F.10***.
4. Apply the correct input power to the Power Wave S350 machine.
5. Locate LED 2 on the PFC Control Board. ***See Figure F.11.***
6. LED 2 should be on and green during proper operation of the PFC Control Board.
7. Locate LED 1 and the audio buzzer on the PFC Control Board. ***See Figure F.11.***
8. If there is a problem with the PFC Control Board LED 1 and the buzzer will provide an error code. ***See Figure F.11*** for error codes. LED 2 will also be OFF or blinking.
9. If further testing is required remove the input power to the machine and perform the resistance checks in ***Table F.8 and Table F.9. See Figure F.11*** and ***Figure F.12*** for test point locations. To access some of the test points the PFC Control Board may have to be removed from its mounting studs. See the Power Factor Correction ***Control Board Removal and Replacement Procedure.***
10. When testing is complete replace all plugs previously remove, the PFC Board and the case covers.

Return to Section TOC
Return to Master TOC

POWER FACTOR CONTROL BOARD TEST PROCEDURE (continued)

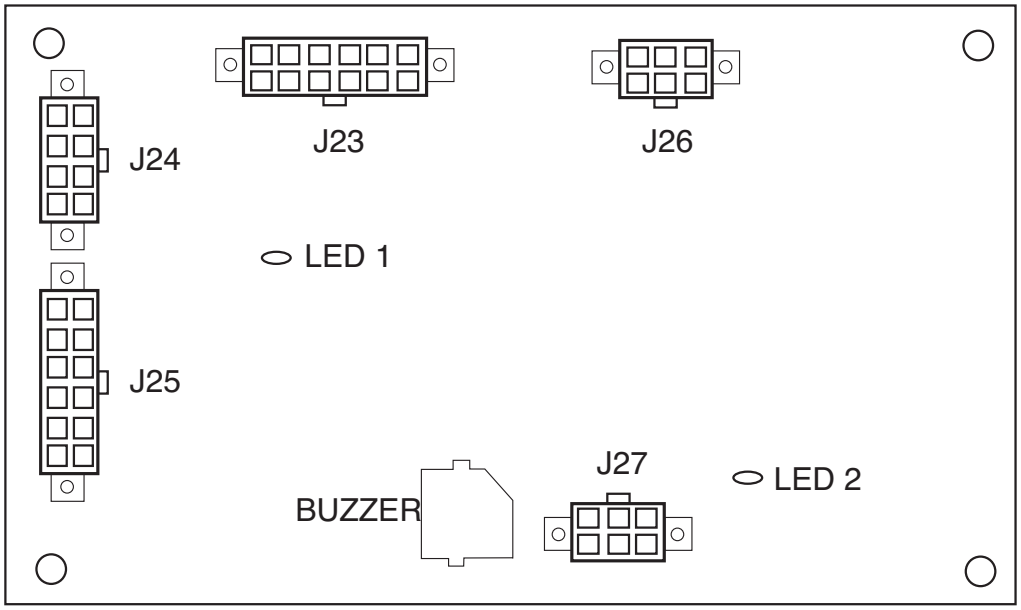
FIGURE F.10 – PFC CONTROL BOARD LOCATION



Return to Section TOC
Return to Master TOC

POWER FACTOR CONTROL BOARD TEST PROCEDURE (continued)

FIGURE F.11 – PFC CONTROL BOARD PLUGS



G5915 PFC CONTROL BOARD P.C. BOARD		
LED #	**COLOR**	**FUNCTION**
2	GREEN	15 VDC POWER SUPPLY FUNCTION PROPERLY WHEN ON
1	RED	ERROR CODE (LED WILL FLASH ERROR AND BUZZER WILL SOUND) SEE TABLE BELOW FOR DETAILS

- Pause before repeating the code: 3.5 seconds
- Pause between digits of the code: 1.5 seconds
- Pause between sounds/flashes indicating a specific digit: 0.5 seconds

ERROR CODE	
ERROR	**EXPLANATION**
331	PEAK INPUT CURRENT LIMIT
334	START UP CURRENT CHECK FAILURE
335	START UP VOLTAGE CHECK FAILURE
336	THERMAL FAULT (NO FIRST STAGE FAN)
337	PRECHARGE TIMEOUT
346	TRANSFORMER PRIMARY OVERCURRENT

Return to Section TOC
Return to Master TOC

POWER FACTOR CONTROL BOARD TEST PROCEDURE (continued)

TABLE F.8 - POWER FACTOR CORRECTION CONTROL BOARD RESISTANCE CHECKS

Description	Meter Test Points and Polarity	Expected Readings	Conditions
Auxiliary Power Input Circuit	Receptacle J27 Pin 3 (-) To Receptacle J27 Pin 4 (+)	Very High resistance. Greater than 50,000 ohms	Input power removed. Remove Plug J27 from the PFC Board. Typical failure is a short
Auxiliary Power DIode Circuit on Switch Board	B48 (-) To Plug J27 Pin 4 (+)	Very High resistance. Greater than 50,000 ohms	Input power removed. Typical failure is a short. If shorted replace the Switch Board
Auxiliary Power DIode Circuit on Switch Board	B12 (-) To Plug J27 Pin 4 (+)	Very High resistance. Greater than 50,000 ohms	Input power removed. Typical failure is a short. If shorted replace the Switch Board
Pre-Charge Relay Drive Circuit	Plug J23 Pin 3 (-) To Plug J23 Pin 4 (+)	High resistance. Greater than 30,000 ohms	Input power removed. Remove Plug J41 from the Switch Board. Typical failure is a short
Full Bridge Gate Drive Circuit	Plug J23 Pin 6 (+) To Plug J23 Pin 5 (-)	High resistance. Greater than 30,000 ohms	Input power removed. Remove Plug J41 from the Switch Board. Typical failure is a short
Main Buck Gate Drive Circuit	Plug J23 Pin 11 (-) To Plug J23 Pin 12 (+)	Resistance should be greater than 500 ohms	Input power removed. Remove Plug J41 from the Switch Board. Typical failure is a short
Auxiliary Buck Gate Drive	Plug J23 Pin 2 (-) To Plug J23 Pin 1 (+)	Resistance should be greater than 500 ohms	Input power removed. Remove Plug J41 from the Switch Board. Typical failure is a short

Return to Section TOC
Return to Master TOC

POWER FACTOR CONTROL BOARD TEST PROCEDURE (continued)

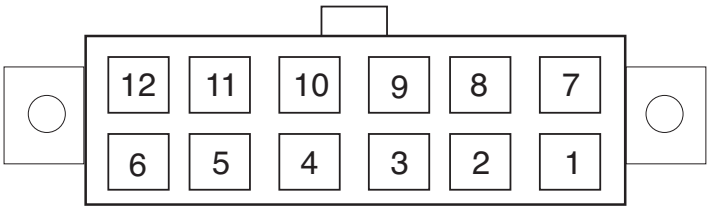
TABLE F9 - POWER FACTOR CORRECTION CONTROL BOARD RESISTANCE CHECKS (continued)

Main Boost Gate Drive	Plug J23 Pin 8 (-) To Plug J23 Pin 7 (+)	Resistance should be greater than 500 ohms	Input power removed. Remove Plug J43 from the Switch Board. Typical failure is a short
Auxiliary Boost Gate Drive	Plug J23 Pin 9 (-) To Plug J23 Pin 10 (+)	Resistance should be greater than 500 ohms	Input power removed. Remove Plug J43 from the Switch Board. Typical failure is a short

Return to Section TOC
Return to Master TOC

POWER FACTOR CONTROL BOARD TEST PROCEDURE (continued)

FIGURE F.12 – PLUG J23



PLUG J27

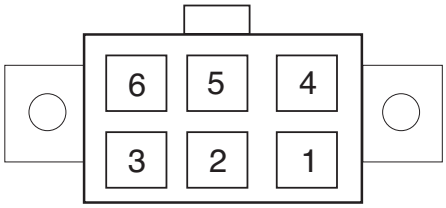
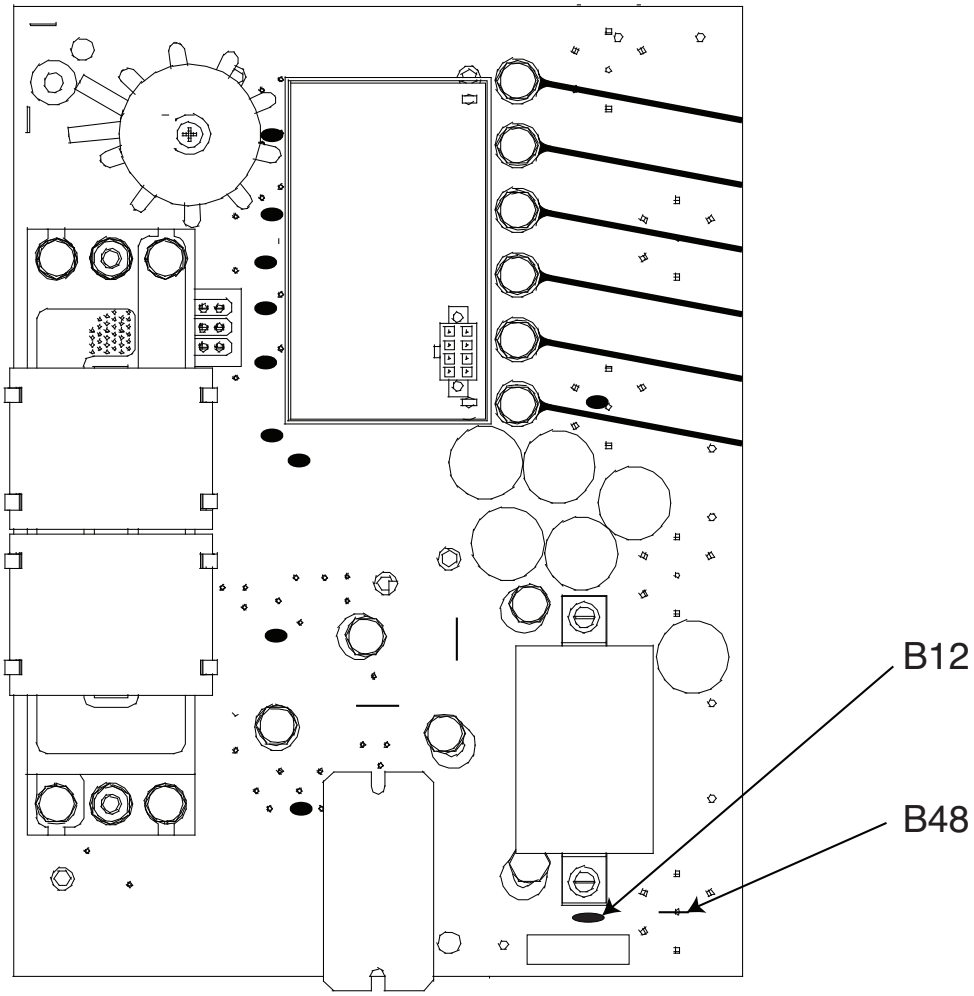


FIGURE F.13 – SWITCH BOARD TEST POINTS



Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CURRENT AND VOLTAGE CALIBRATION PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in checking and, if necessary, adjusting the calibration of the POWER WAVE S350.

Calibration should be checked as part of the **Test After Repair**.

MATERIALS NEEDED

Diagnostic Utilities Software (www.powerwavemanager.com or Service Navigator)
Laptop or other Suitable Computer
Ethernet Cross Connect Cable (LECO #M19969-7)
Resistive Load Bank
Two (2) Welding Cables - 20ft. -4/0
Calibrated Ammeter and Voltmeter *

* Calibration inaccuracies due to external metering can and will effect weld performance. Use good quality digital meters that are **calibrated and traceable to National Standards.**

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CURRENT AND VOLTAGE CALIBRATION PROCEDURE (continued)

CALIBRATION SET-UP:

1. Load the Diagnostic Utility Software into the computer.
2. Use the Ethernet cable to connect the computer to the Power wave S350.
3. Connect a resistive load bank to the output studs.
4. Energize the Power wave S350.
5. Launch the Diagnostic Utility and establish communication with the Power wave S350 (Refer to the Software Documentation to determine proper connection)
6. Click on the "Calibration" Tab. A screen similar to ***Figure F.14*** should appear and you are ready to begin the calibration check.

NOTE: The Calibration Screen may look slightly different depending on the Software version.

Calibration can only be done under "Static Load" conditions. Do not attempt to calibrate while welding.

NOTE: Incorrect calibration can and will affect welding performance. It is strongly recommended to use the "Diagnostics" screen to run and save a "Snapshot" before making any calibration adjustments. This will allow returning to original settings if necessary. (Refer to the Software Documentation for instructions on using the Snapshot feature).

CALIBRATION PROCEDURE:

1. Once in the "Calibration" screen, make sure that the machine output is OFF (light is BLACK) and connect a resistive load bank to the output studs.
2. Set the load bank for 200 Amps.
3. On the Calibration screen, select the 200 Amps Current Set Point.

NOTE: If the meters on the load bank are not certified, connect calibrated and traceable meters to the machine output. (See ***Materials Needed*** at the beginning of this Section).

⚠ WARNING

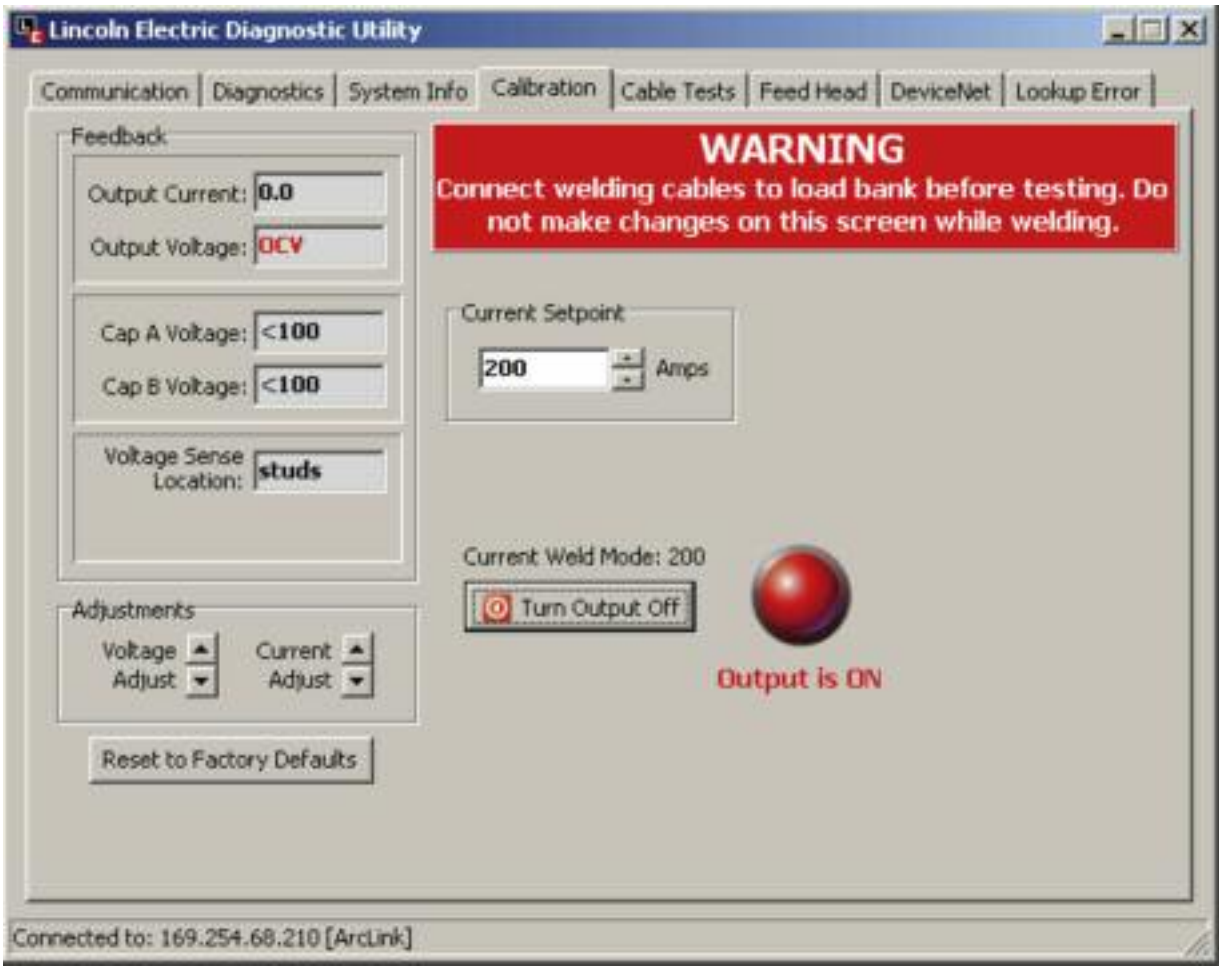
The Output Studs of the Machine will be Electrically "HOT" during Steps 4 thru 7

4. Click on the "Turn Output ON" button. The BLACK light on the screen will flash RED indicating that the weld output is turned ON. ***See Figure F.14.***
5. Adjust the load bank to 200 Amps at approximately 24 Volts as read on the external calibrated meters.
6. Using the "Calibration Adjustment" buttons: Adjust the current so that the external ammeter reads 200 Amps +/-2A. Adjust the voltage so that the "Output Voltage" display window reads the same as the external voltmeter +/-.25volts.
7. Click on the "Turn Output OFF" button. Calibration is complete. (Also check at 300 Amps + 50 Amps)

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CURRENT AND VOLTAGE CALIBRATION PROCEDURE (continued)

FIGURE F.14 – CALIBRATION SCREEN



NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

OPTIONAL USER INTERFACE BOARD TEST PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the User Interface Board is functional.

MATERIALS NEEDED

Voltmeter/Ohmmeter (Multimeter)

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

OPTIONAL USER INTERFACE BOARD TEST PROCEDURE (continued)

PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. To gain access to the User Interface Board test points remove the four screws from the front display panel. Carefully remove the optional user interface board leaving the four pin connector in place.
3. Carefully apply the correct input power to the Power Wave S350 machine.
4. If the displays light on the front of the machine the User Interface is receiving the correct input voltage. (40VDC)
5. ***See Table F.10***. and ***Figure F.15***. for the description of the LED functions on the User Interface Board.
6. If the displays do not light carefully check to make sure the User Interface Board is receiving the correct input supply voltage. ***See Figure F.16***. and the wiring diagram. If the supply voltage (40VDC) is present and the user interface board does not light up the board may be faulty. If the correct supply voltage is not present proceed to the next step.
7. Remove the input power to the Power Wave S350 machine and discharge the DC Link Capacitor. Check the continuity of the supply leads (51D and 52D) between Plug J31 on the User Interface Board and Plug J47 on the DC Bus Board. Also check the continuity of the CAN communication leads (153D and 154D) between Plug J31 and Plug J11 on the PFC Board. See the wiring diagram.
8. Make sure the green ground lead is securely connected to the user interface board.
9. Replace the case covers, plugs and P.C. Boards previously removed.

Return to Section TOC
Return to Master TOC

OPTIONAL USER INTERFACE BOARD TEST PROCEDURE (continued)

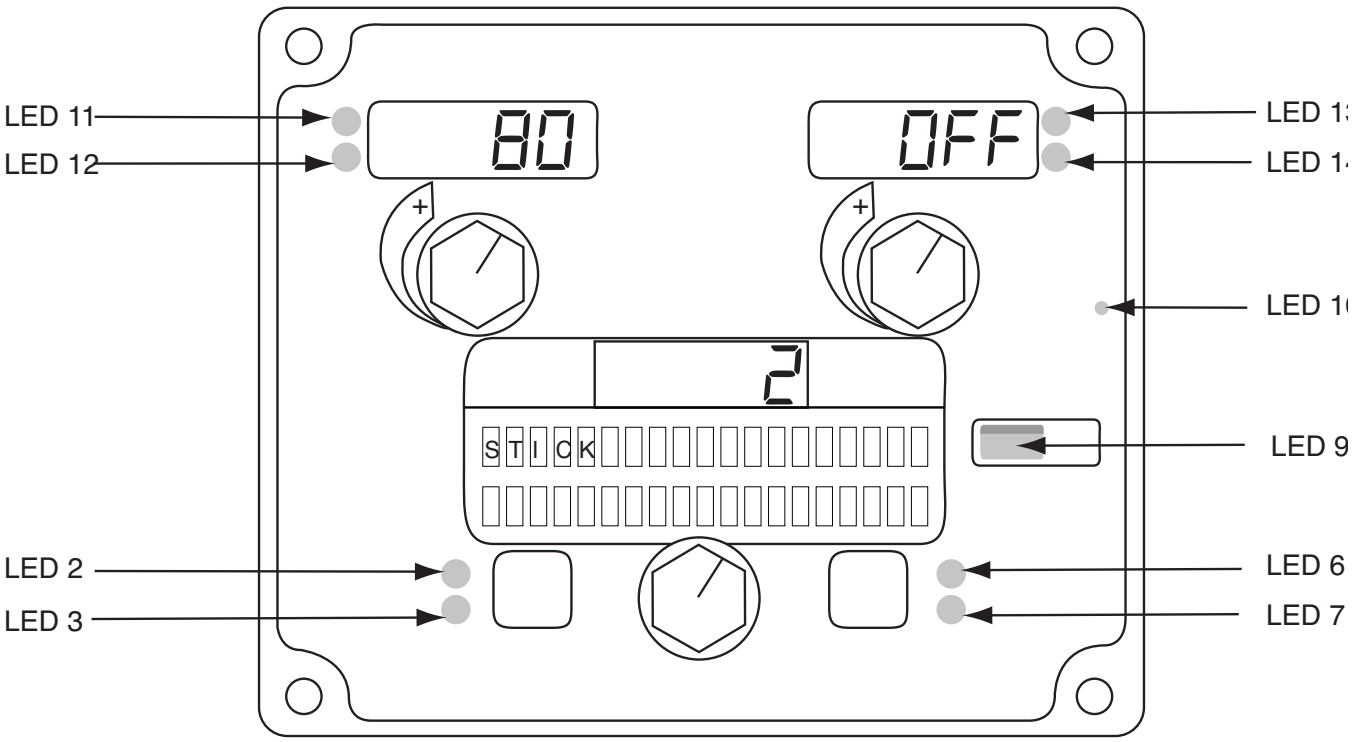
Table F.10 - Description of LED Functions
Optional User Interface Board

LED #	COLOR	FUNCTION
2	RED	PROCESS SELECT
3	RED	WAVE COTROL SELECT
6	RED	PRE-WELD CONTROL SELECT
7	RED	POST-WELD CONTROL SELECT
9	RED	SETUP MENU ENABLED
10	RED	THERMAL FAULT MEASURED
11	RED	WIRE FEED SPEED SELECT
12	RED	AMPS SELECT
13	RED	VOLTS SELECT
14	RED	TRIM SELECT

Return to Section TOC
Return to Master TOC

OPTIONAL USER INTERFACE BOARD TEST PROCEDURE (continued)

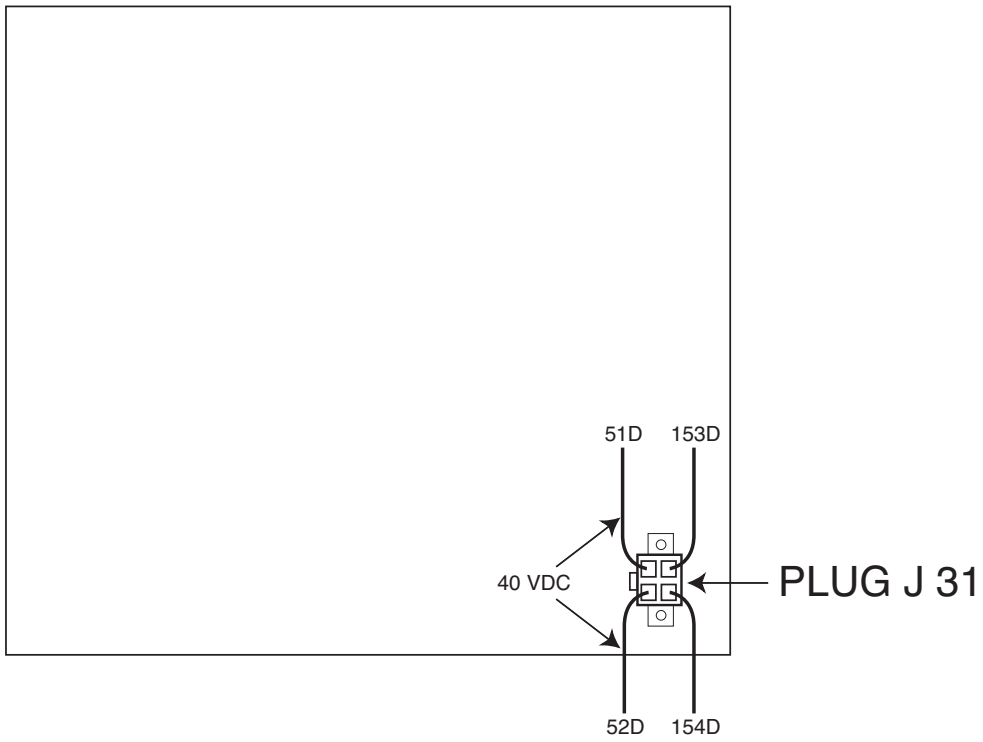
FIGURE F.15 – U.I. FRONT VIEW (G4760 Series)



Return to Section TOC
Return to Master TOC

OPTIONAL USER INTERFACE BOARD TEST PROCEDURE (continued)

FIGURE F.16 – PLUG J31 LOCATION ON USER INTERFACE BOARD (rear view)



NOTE: Leads connect to user interface harness. (4 pin connection to 6 pin connection)

Return to Section TOC
Return to Master TOC

NOTES

F-48

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

INPUT RECTIFIER TEST PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will help determine if the input rectifier has “shorted” or “open” diodes.

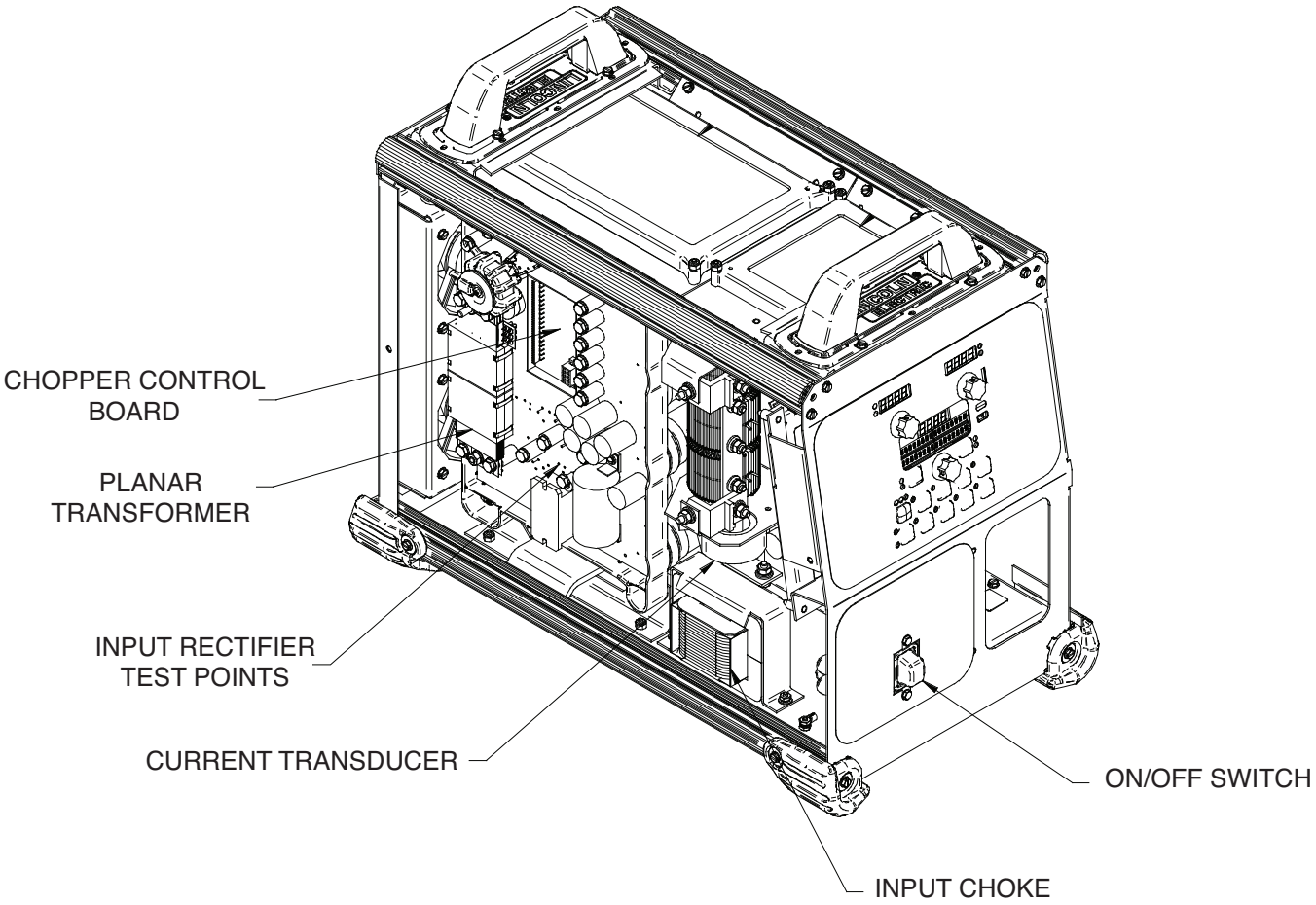
MATERIALS NEEDED

Digital Volt-Ohmmeter (DVM)
Misc. Hand Tools
Wiring Diagram

Return to Section TOC
Return to Master TOC

INPUT RECTIFIER TEST PROCEDURE (continued)

FIGURE F.17 – INPUT RECTIFIER LOCATION



PROCEDURE

1. Remove the input power to the machine.
2. Perform the ***Case Cover Removal and DC Link Capacitor Discharge Procedure.***
3. Locate the Input Rectifier and associated leads. See Figure F.17 and ***Figure F.18.***
4. Use the digital voltmeter (DVM) set to the diode test mode to perform the tests detailed in ***Table F.11.***
5. If the Input Rectifier does not meet the expected readings replace the Switch Board.

Return to Section TOC
Return to Master TOC

INPUT RECTIFIER TEST PROCEDURE (continued)

FIGURE F.18 – INPUT RECTIFIER LEAD LOCATIONS

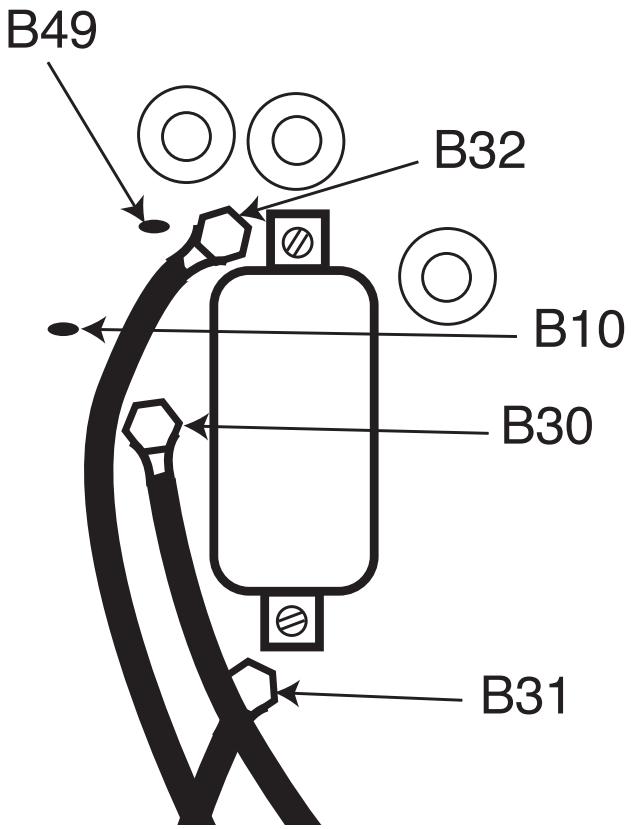


TABLE F.11 – PROBE READINGS

+Probe (RED)	-Probe (BLACK)	RESULT
Terminal B32	Terminal B10	0.3V - 1.0V
Terminal B31	Terminal B10	0.3V - 1.0V
Terminal B30	Terminal B10	0.3V - 1.0V
Terminal B49	Terminal B32	0.3V - 1.0V
Terminal B49	Terminal B31	0.3V - 1.0V
Terminal B49	Terminal B30	0.3V - 1.0V

Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

PLANAR TRANSFORMER RESISTANCE TEST PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will help determine if the Planar Transformer windings are good and not shorted to each other or to ground.

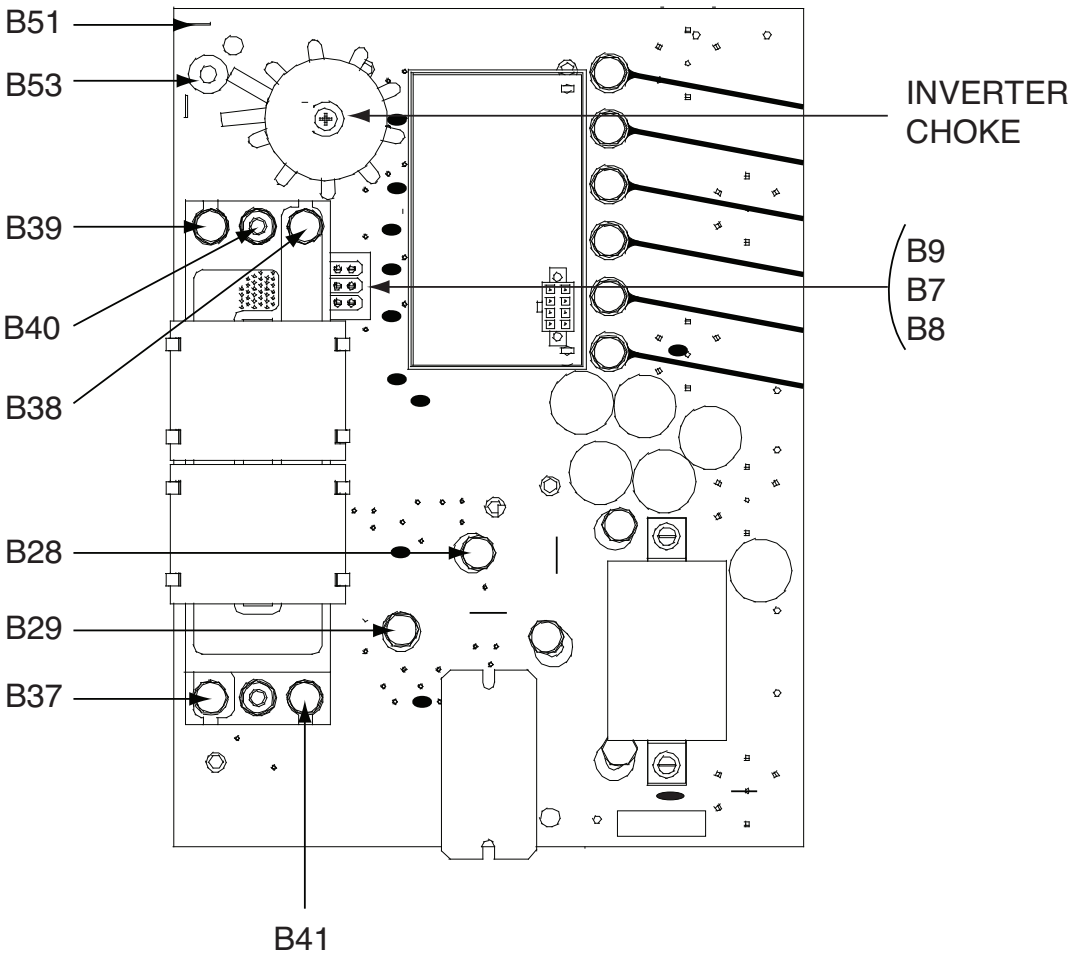
MATERIALS NEEDED

Voltmeter/Ohmmeter (Multimeter)

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

PLANAR TRANSFORMER RESISTANCE TEST PROCEDURE (continued)

FIGURE F.21 - TEST POINTS



PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. To gain access to the Planar Transformer test points first perform the ***Case Cover and DC Link Capacitor Discharge Procedure.***
3. See Figure F.21 for test point locations.
4. Using the Ohmmeter check the resistances per ***Table F.12.***
5. If the resistances are correct per ***Table F.12*** then the Planar Transformer is OK.
6. Replace the Case Cover.

Return to Section TOC
Return to Master TOC

PLANAR TRANSFORMER RESISTANCE TEST PROCEDURE (continued)

TABLE F.12 – RESISTANCE CHECKS

Test Points	Expected Resistance	Comments
B37 to B41	Zero ohms	Continuity of Primary Winding
B39 to B40	Zero ohms	Continuity of 1/2 of Secondary Winding
B40 to B38	Zero ohms	Continuity of 1/2 of Secondary Winding
B8 to B7	Zero ohms	Continuity of 1/2 of 48V Winding
B7 to B9	Zero ohms	Continuity of 1/2 of 48V Winding
B37 to B40	Infinity	Isolation between Primary and Secondary Winding
B37 to B7	Infinity	Isolation between Primary and 48V Winding
B40 to B7	Infinity	Isolation between Secondary and 48V Windings
All Test Points to Chassis Ground	Infinity	Isolation from all windings to chassis ground

Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

OUTPUT RECTIFIER TEST PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the Output Rectifier is “open” or “shorted”.

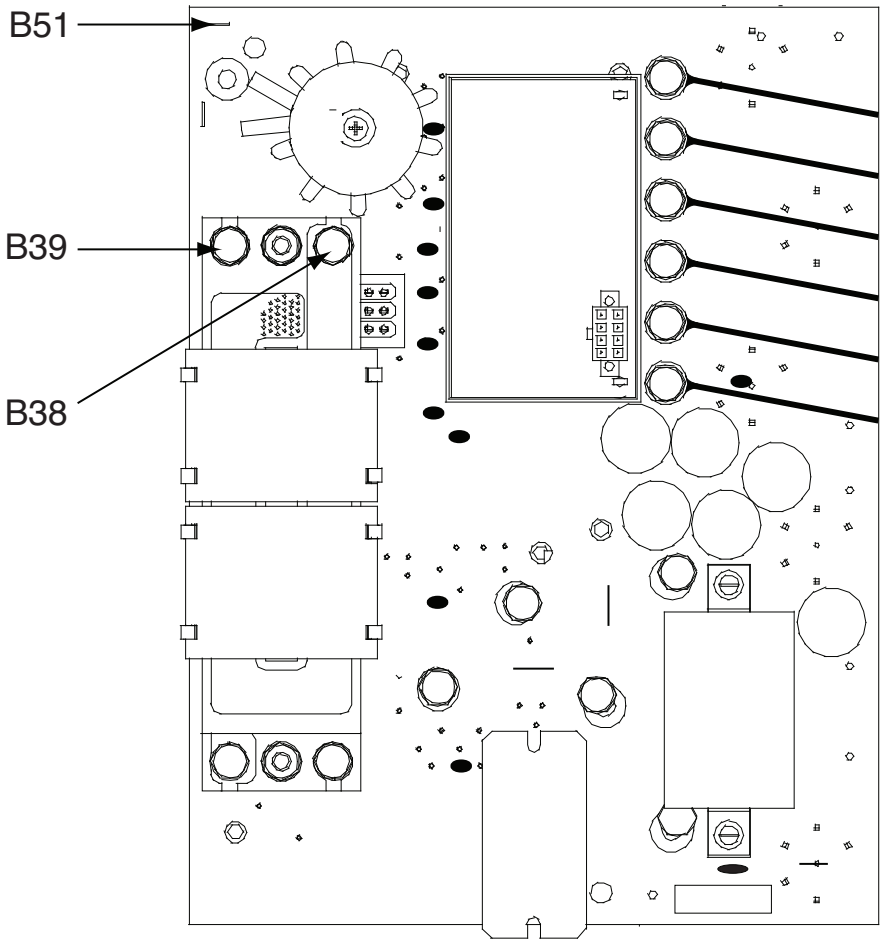
MATERIALS NEEDED

Voltmeter/Ohmmeter (Multimeter)

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

OUTPUT RECTIFIER TEST PROCEDURE (continued)

FIGURE F.22 – TEST POINTS



PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. To gain access to the Output Rectifier test points first perform the ***Case Cover and DC Link Capacitor Discharge Procedure.***
3. Locate test points B51, B38 and B39. See Figure F.22.
4. Disconnect lead #207 from the 200 ohm 100 watt output resistor. See wiring diagram.
5. Using the ohmmeter check the resistances from B51 to B38/ B39. Polarity of the ohmmeter is important. With the positive meter probe on B51 and the negative meter probe on B38/B39 the resistance reading should be very high. With the positive meter probe on B38/B39 and the negative probe on B51 the resistance reading should be very low. Thus a forward diode drop. If the meter readings indicate a very low resistance is both directions the output rectifier may be shorted. If the meter readings indicate a very high resistance in both directions the output rectifier may be open.
6. If the Output Rectifier is faulty the entire Switch Board must be replaced.
7. Replace lead #207.
6. Replace the case covers.

Return to Section TOC
Return to Master TOC

CURRENT TRANSDUCER TEST PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will help determine if the Current Transducer and associated wiring is functioning correctly.

MATERIALS NEEDED

Misc. Hand Tools
Lap-top computer
Diagnostic Utilities Software
Ethernet Cross Connect Cable (LE Co.#M19969-7)
Resistive Load Bank (Optional 50 ft. 4/0 weld cable)
Calibrated Ammeter
Volt-Ohmmeter

Note: The Diagnostic Utility Software is on the Utilities Disc that was shipped with the machine. It can also be accessed from the Lincoln Service Navigator or downloaded from the “web” at Powerwavemanager.com

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CURRENT TRANSDUCER TEST PROCEDURE (continued)

PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. To gain access to the Current Transducer first perform the ***Case Cover and DC Link Capacitor Discharge Procedure.***
3. Locate plug J8 on the Control Board. ***See Figure F.23.*** To gain access to the Control Board remove the right case side**.**
4. Locate the Current Transducer. ***See Figure F.24.***
5. Carefully apply the correct input power to the Power Wave S350.
6. Check for the correct DC supply voltage to the current transducer. ***See Figure F.23*** for Plug J8.
   A. Pin 2 (lead 212+) to Pin 6 (lead 214- or 216) should read +15VDC.
   B. Pin 3 (lead 213-) to pin 6 (lead 214+ or 216) should read -15VDC.

Note: Do not attempt to check the voltages at the current transducer connector. The terminals are small and delicate and may be damaged if probed with meter leads.

If the DC supply voltages are not present the Control Board may be faulty. If the supply voltages are correct, proceed to Step 7.

For Steps 7 through 13 refer to the information in the Diagnostic Utility found on the Lincoln Service Navigator or at Powerwavemanager.com

7. Using the Ethernet Cross Connect cable, connect a laptop computer to the Power Wave S350 via the Ethernet port located at the top rear of the machine. ***See Figure F.25.***
8. Connect a load bank (or 50 Ft. weld cable) to the Positive and Negative output terminals on the Power Wave S350.
9. Using the "Diagnostic Utility Software":
   a. Establish Communication with the PW S350
   b. Select the "Calibrate" tab
   c. Select the "50 amp" current set point
   d. Select "Turn Output On"
   e. Use an external calibrated ammeter that is not affected by inverter noise to read the actual current.
10. Check the current transducer's feedback voltage at the Control Board plug J8 per ***Table F.13.*** Pin 1 (lead 211+) to pin 6 (lead 214-). ***See Figure F.23.*** for pin locations.
11. Repeat the test at several other current levels. If the transducer feedback voltage is correct for the actual current, the current transducer is functioning properly. If there is no feedback voltage, check the wiring from the control board to the current transducer. See the wiring diagram.

⚠ CAUTION

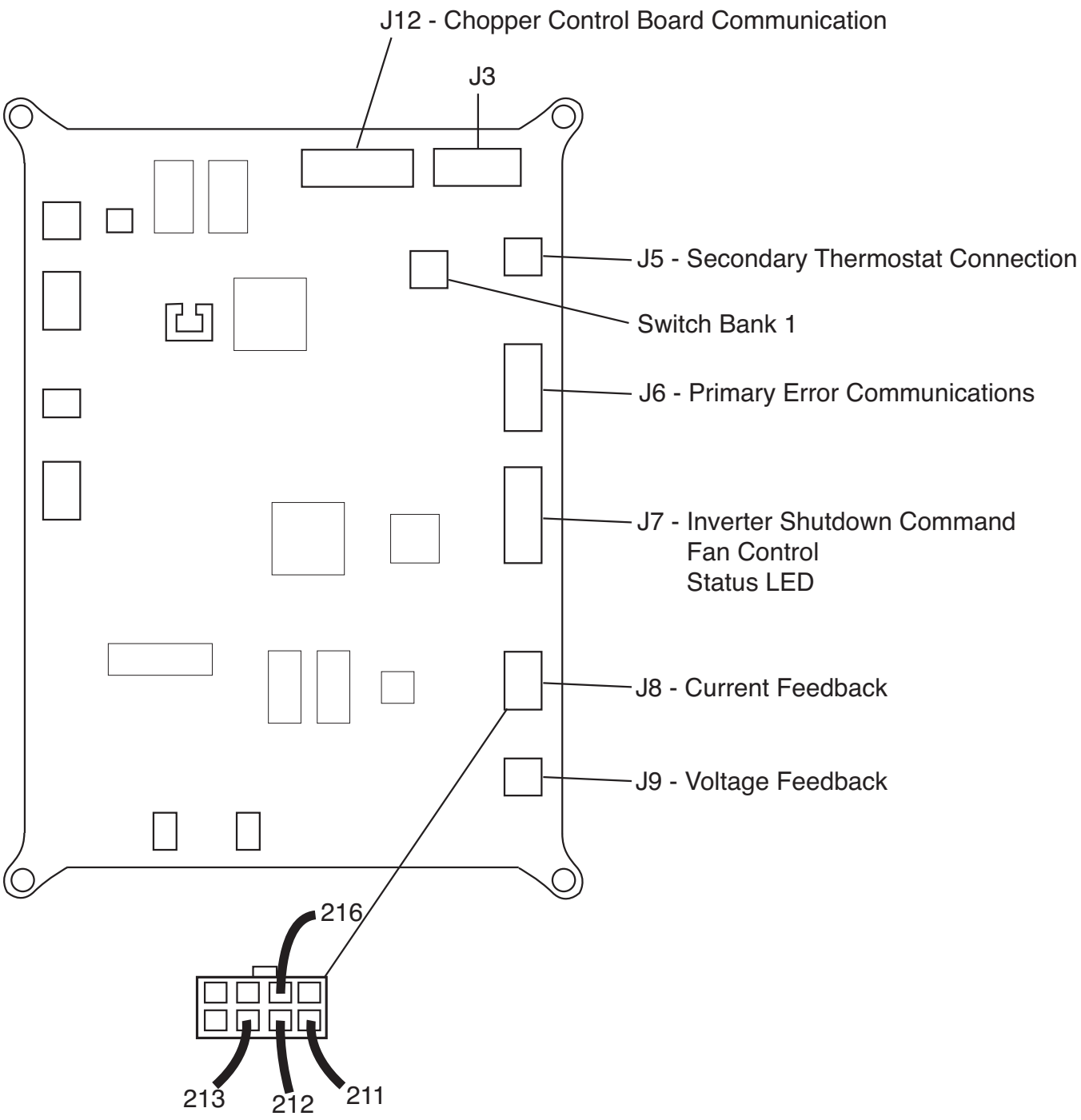
If using a weld cable across the output terminals instead of a load bank, do not exceed the current rating of the cable.

12. If the supply voltages are correct but the current transducer feedback voltages are incorrect the current transducer or wiring from the current transducer to the control board may be defective. See the wiring diagram.
13. Click on "Turn Output Off"
14. Disconnect the laptop computer.
15. Remove the input power to the PW S350 machine.
16. Replace the case covers.

Return to Section TOC
Return to Master TOC

CURRENT TRANSDUCER TEST PROCEDURE (continued)

FIGURE F.23 – PLUG LOCATIONS ON CONTROL BOARD



Return to Section TOC
Return to Master TOC

CURRENT TRANSDUCER TEST PROCEDURE (continued)

FIGURE F.24 – CURRENT TRANSDUCER LOCATION

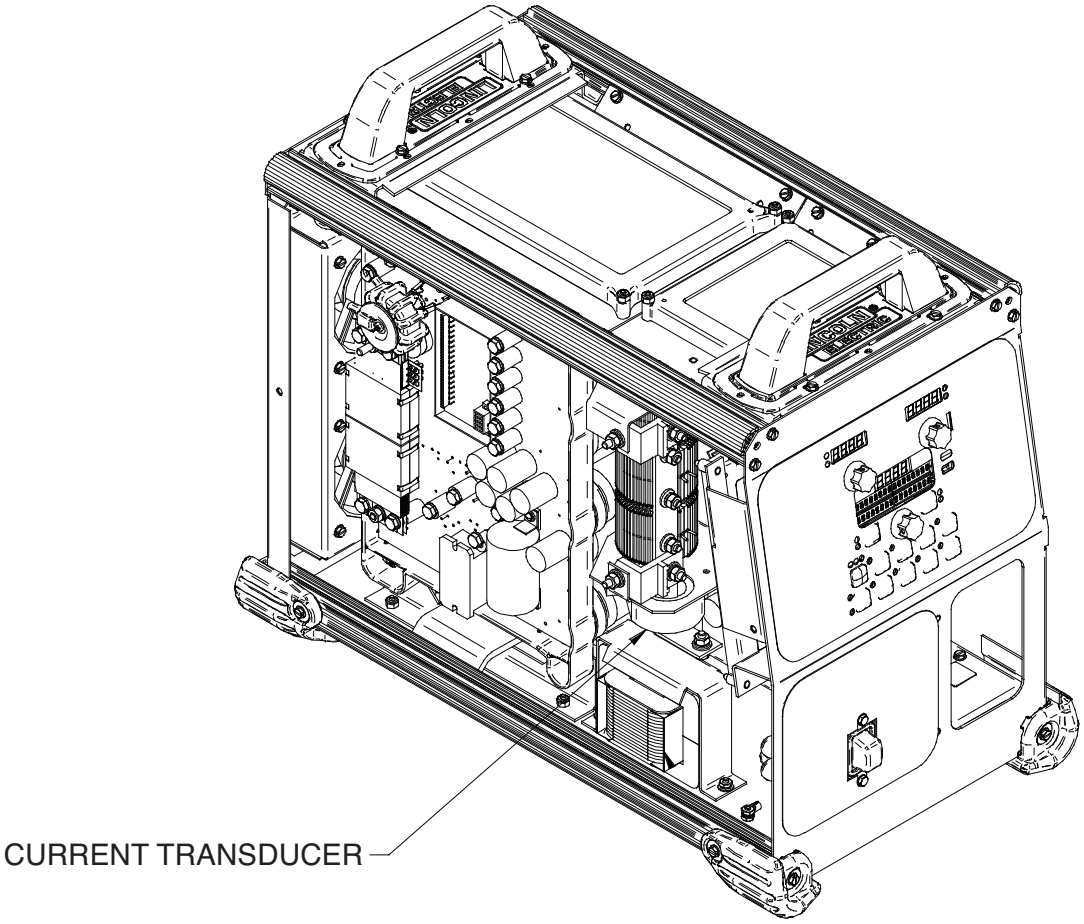


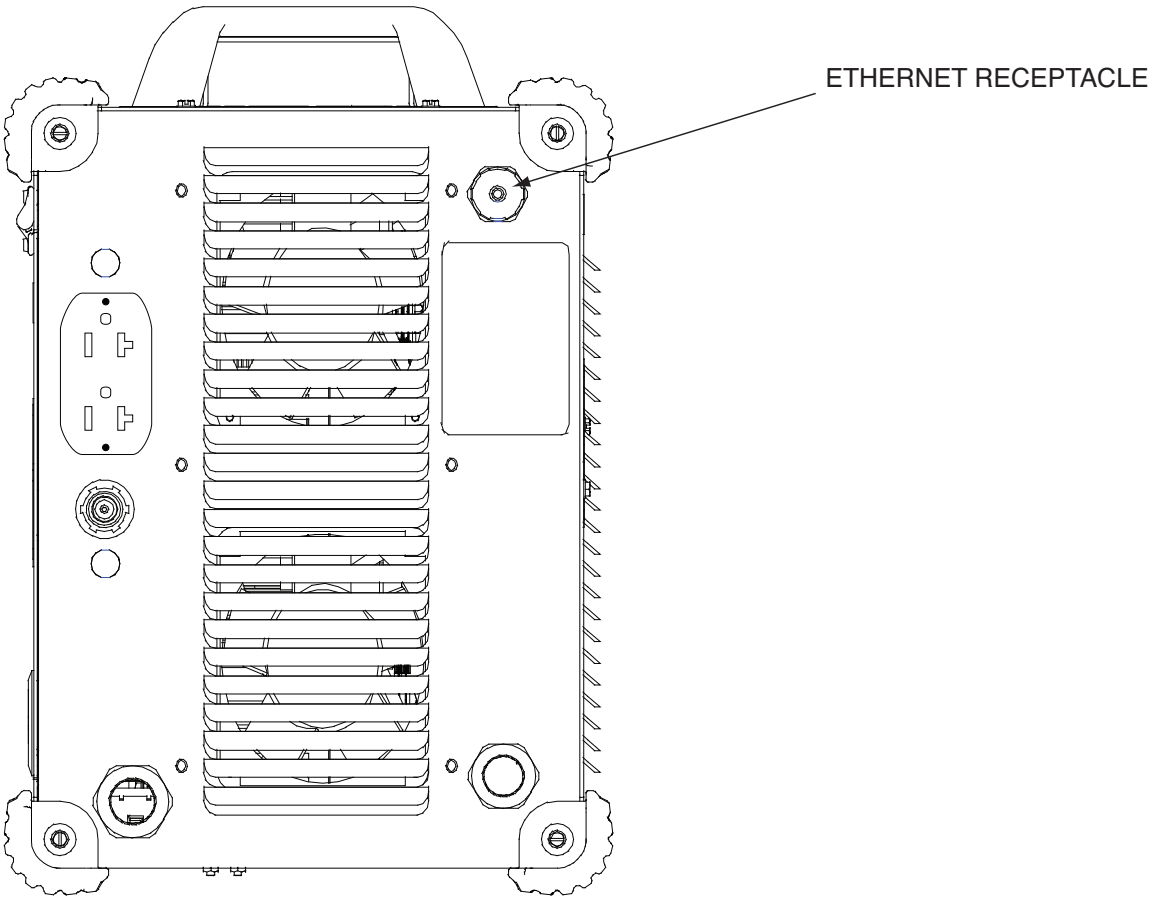
TABLE F.13

OUTPUT CURRENT (ACTUAL)	TRANSDUCER FEEDBACK VOLTAGE
500	4.0
450	3.6
400	3.2
350	2.8
300	2.4
250	2.0
200	1.6
150	1.2
100	0.8
50	0.4

Return to Section TOC
Return to Master TOC

CURRENT TRANSDUCER TEST PROCEDURE (continued)

FIGURE F.25 – ETHERNET RECEPTACLE



Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

DC BUS BOARD TEST

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

The procedure will aid the technician in determining if the DC Bus Board is functional.

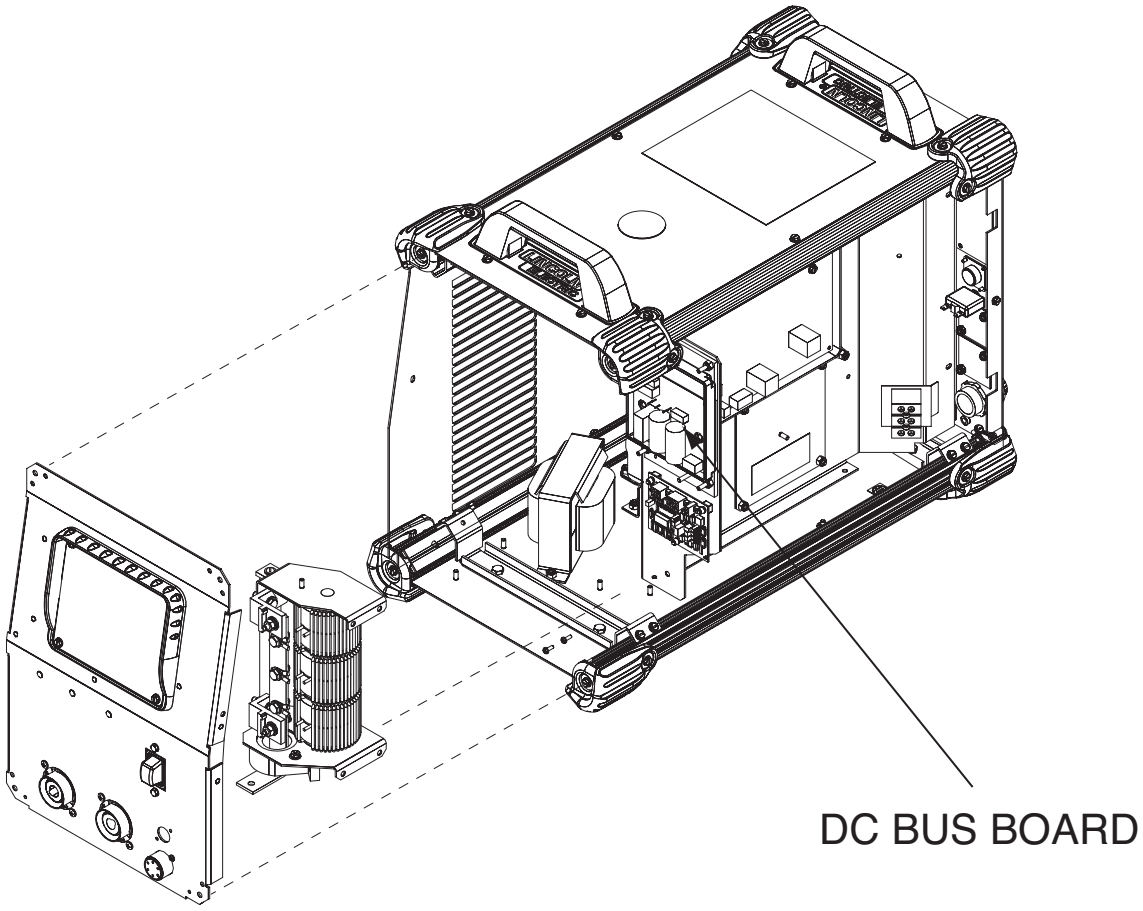
MATERIALS NEEDED

Volt-Ohmmeter

Return to Section TOC
Return to Master TOC

DC BUS BOARD TEST (continued)

FIGURE F.26 – DC BUS BOARD LOCATIONS



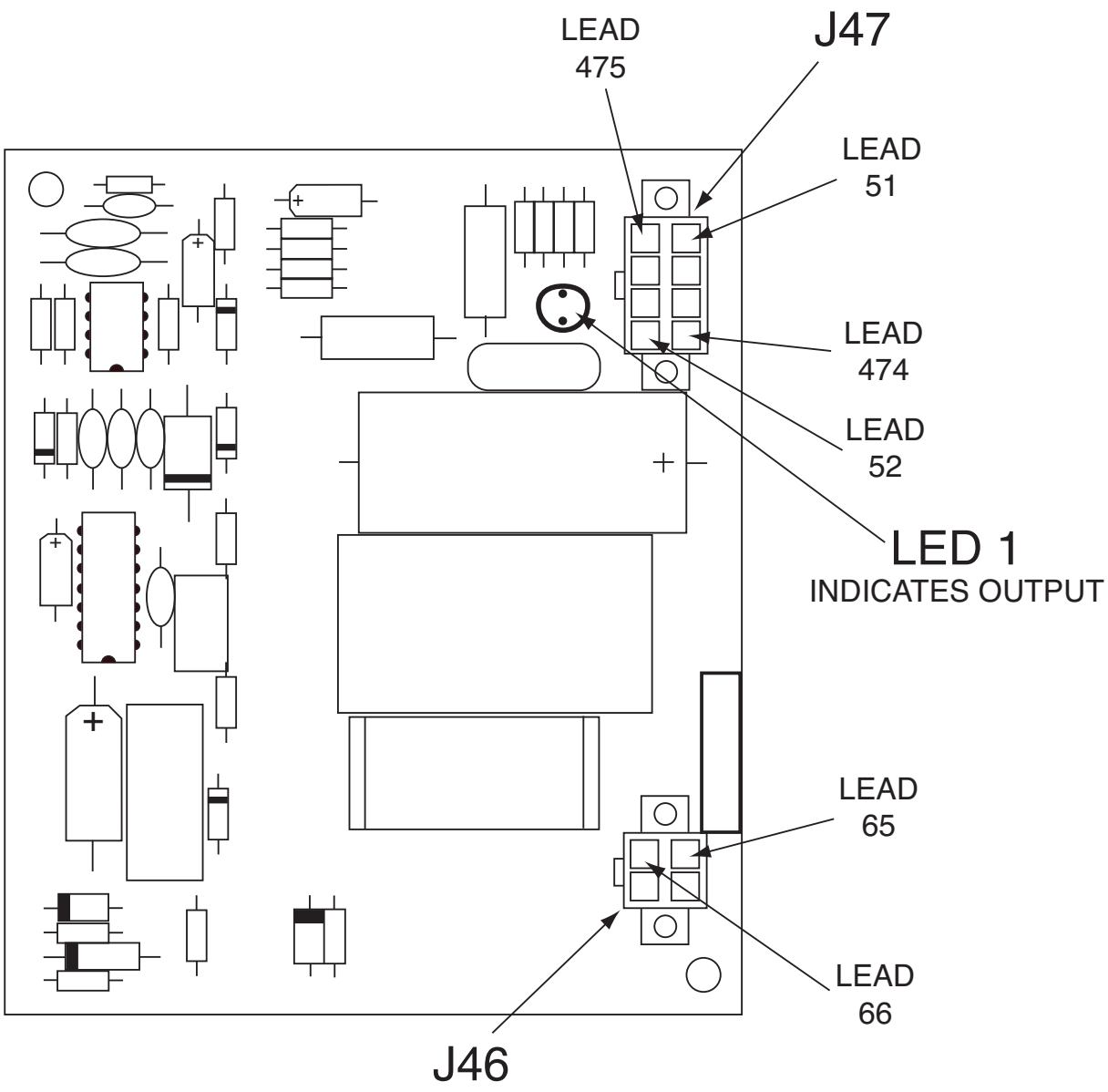
PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. To gain access to the DC Bus Board see the Case Cover Removal and DC Link Capacitor Discharge Procedure. Remove the right case side cover.
3. Locate the DC Bus Board. See Figure F.26.
4. Carefully apply the correct input voltage to the Power wave S350 machine.
5. Locate LED1 on the DC Bus Board. ***See Figure F.27***. If LED1 is bright red and steady the DC Bus Board is OK. If the LED1 is dim or not steady remove the input power and disconnect Plug J47. ***See Figure F.27***. When power is reapplied if the LED1 is bright and steady check for a heavy load or short on leads 51-52 and check the resistor at leads 474 and 475. The resistance should be 250 ohms. See wiring diagram.
6. If LED1 is not ON proceed to the next steps.
7. Carefully check to ensure that the correct input voltage (48VDC) is being applied to the DC Bus Board. Plug J46 Pin 1 (lead 65+) to Plug J46 (lead 66-). ***See Figure F.27***.
8. If the correct input voltage is not present (48VDC) check the circuit breaker and associated wiring between the DC Bus Board and the Switch Board. See the wiring diagram.
9. If the correct input voltage is being applied to the DC Bus Board check for the correct output voltages.
10. Check for the presence of 40VDC at Plug J47 Pin1 (Lead 51-) to Plug J47 Pin 8 (Lead 52+). ***See Figure F.27***.
11. Check for the presence of 40VDC at Plug J47 Pin5 (Lead 475-) to Plug J47 Pin4 (Lead 474+). ***See Figure F.27***.
12. If the correct input voltage is being applied to the DC Bus Board and the output voltages are not correct or missing the DC Bus Board may be faulty.

Return to Section TOC
Return to Master TOC

DC BUS BOARD TEST (continued)

FIGURE F.27 – DC BUS BOARD LOCATIONS



Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

POWER FACTOR CORRECTION CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid in the removal and replacement of the Power Factor Correction Control Board.

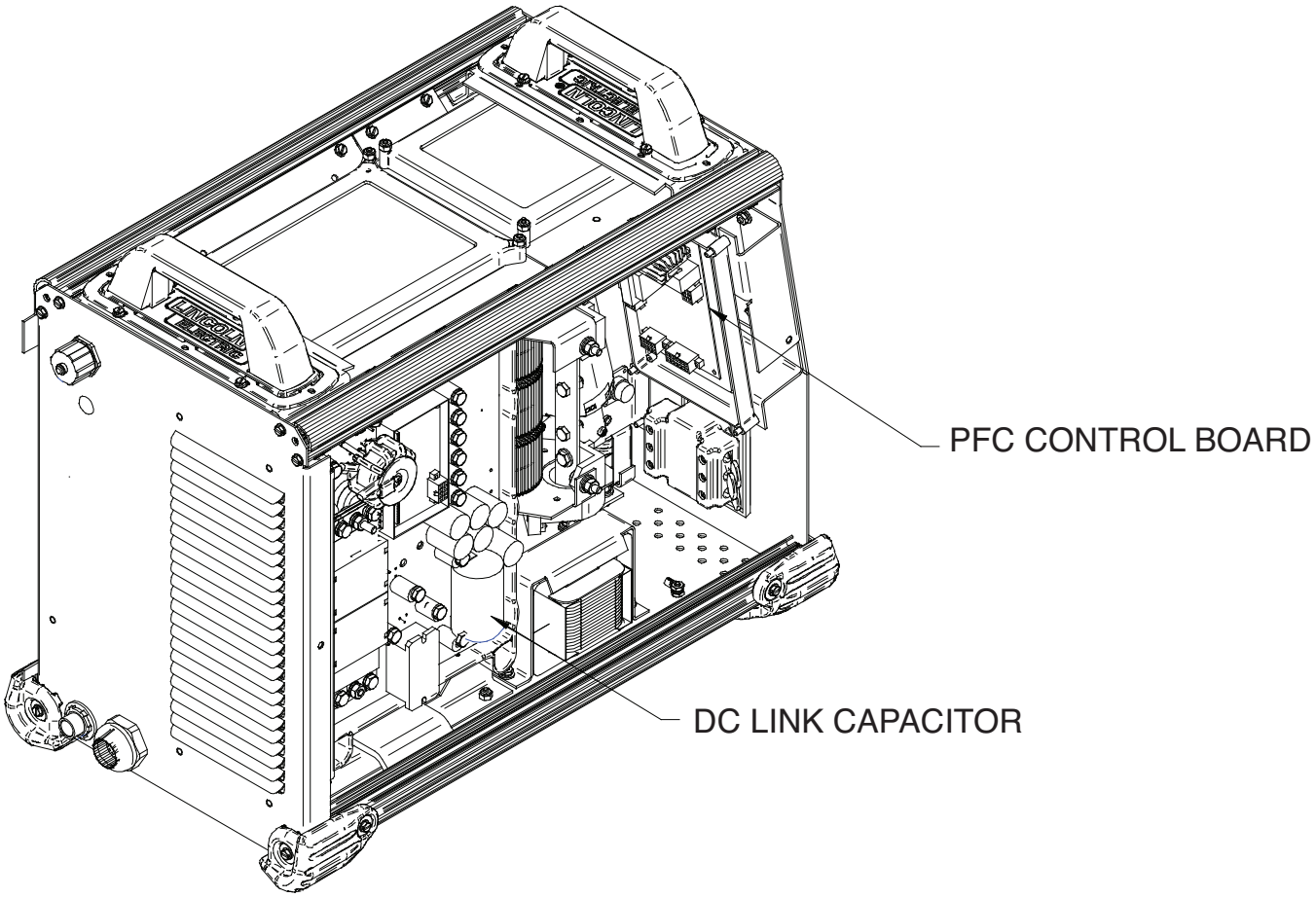
MATERIALS NEEDED

3/8" Nutdriver

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

POWER FACTOR CORRECTION CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.28 – CAPACITOR & PFC CONTROL BOARD LOCATION



PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. To gain access to the PFC Control Board see the ***Case Cover Removal and DC Link Capacitor Discharge Procedure.***
3. Locate the PFC Control Board and using the 3/8 inch nutdriver remove the three nuts securing the PFC Control Board. See Figure F28.
4. Carefully slide the PFC Control Board from the mounting studs.
5. Remove the five molex type plugs from the board. Label locations for reassembly.
6. Install the new board and replace the molex type plugs previously removed.
7. Replace the three nuts previously removed.
8. Replace the left case side. See the ***Case Cover Removal and DC Link Capacitor Discharge Procedure.***

Return to Section TOC
Return to Master TOC

CURRENT TRANSDUCER (LEM) REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid in the removal and replacement of the Current Transducer (LEM) Module.

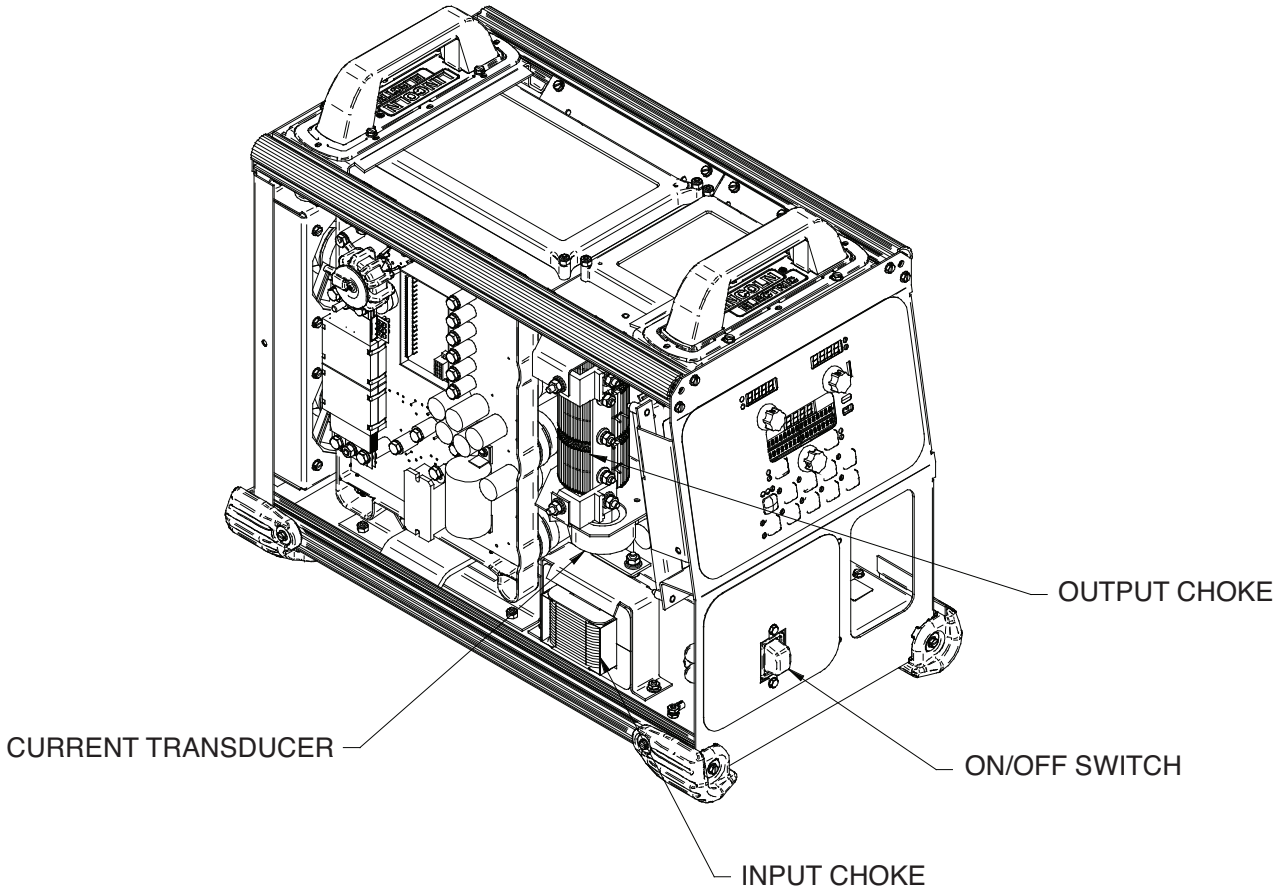
MATERIALS NEEDED

11/32 Inch Wrench
7/16 Inch Wrench
Flat Head Screwdriver

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CURRENT TRANSDUCER (LEM)
REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.29 – CURRENT TRANSDUCER LOCATION



PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. To gain access to the Current Transducer see the ***Case Cover Removal and DC Link Capacitor Discharge Procedure.***
3. Locate the Current Transducer Module on the left side of the machine. See Figure F.29.
4. Locate and carefully unplug the four pin molex type plug from the Current Transducer. It is located on the underneath side of the module.
5. Using the flat head screwdriver and the 11/32 inch wrench remove the two machine screws, flat washers, lock washers and nuts mounting the Current Transducer Module to the output choke bracket.
6. Using the 7/16 inch wrench remove the negative output flex cable from the output choke aluminum strap.
7. Take note of the arrow direction on Current Transducer Module. The new Module must be installed with the arrow pointing in the same direction.
8. Carefully remove the Current Transducer Module from the aluminum strap. This may require some gentle twisting.
9. Carefully place the new Current Transducer Module into the proper position taking note of the arrow direction discussed in Step 7.
10. Mount the new Current Transducer Module to the output choke bracket using the machine screws, washers and nuts previously remove.
11. Attach the negative output flex cable to the output choke aluminum strap.
12. Replace the four pin molex type plug into the new Current Transducer Module.
13. Replace the left case side. See the ***Case Cover Removal and DC Link Capacitor Discharge Procedure.***

Return to Section TOC
Return to Master TOC

CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid in the removal and replacement of the Control Board.

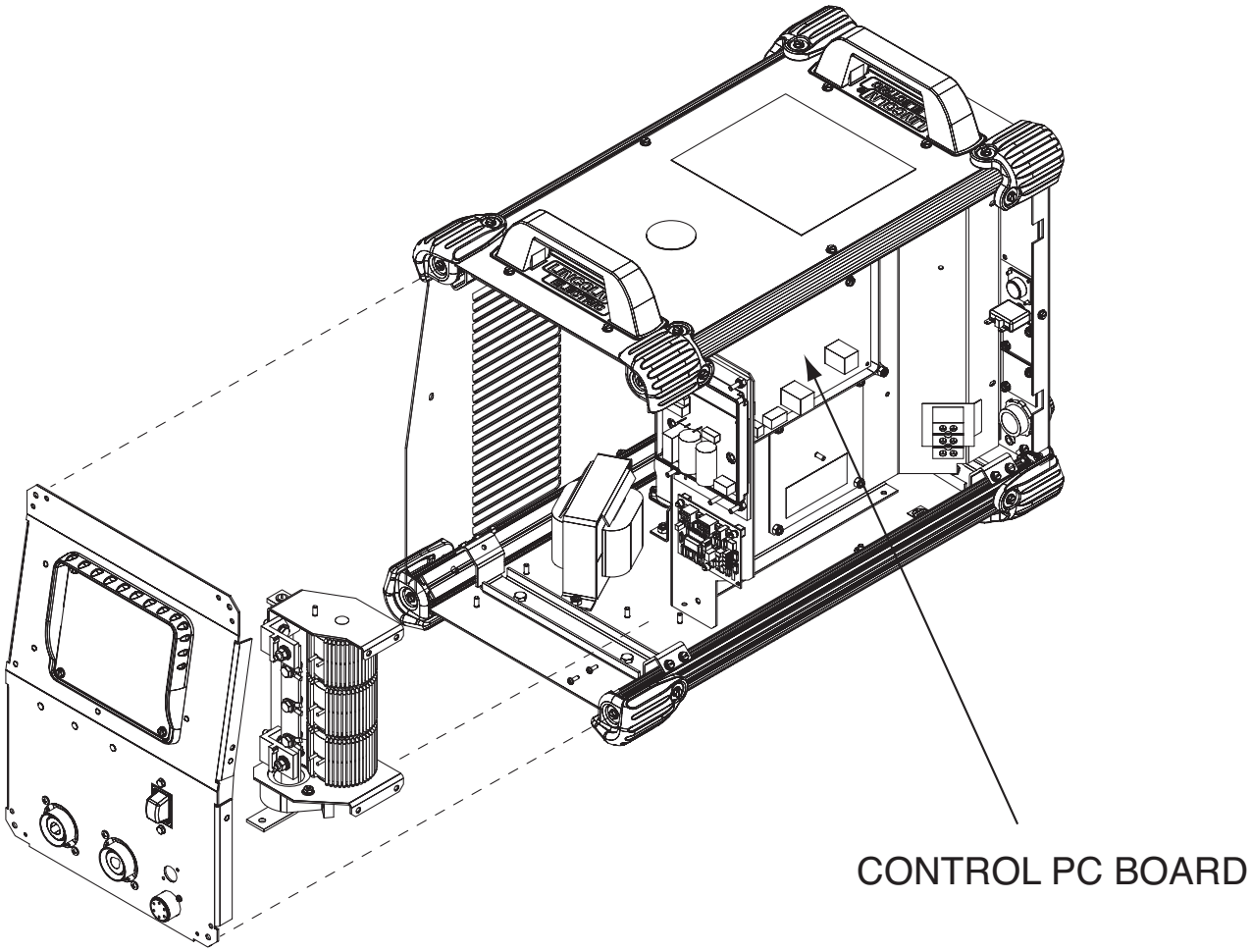
MATERIALS NEEDED

3/8 Inch Nutdriver

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.30 – CONTROL BOARD LOCATION



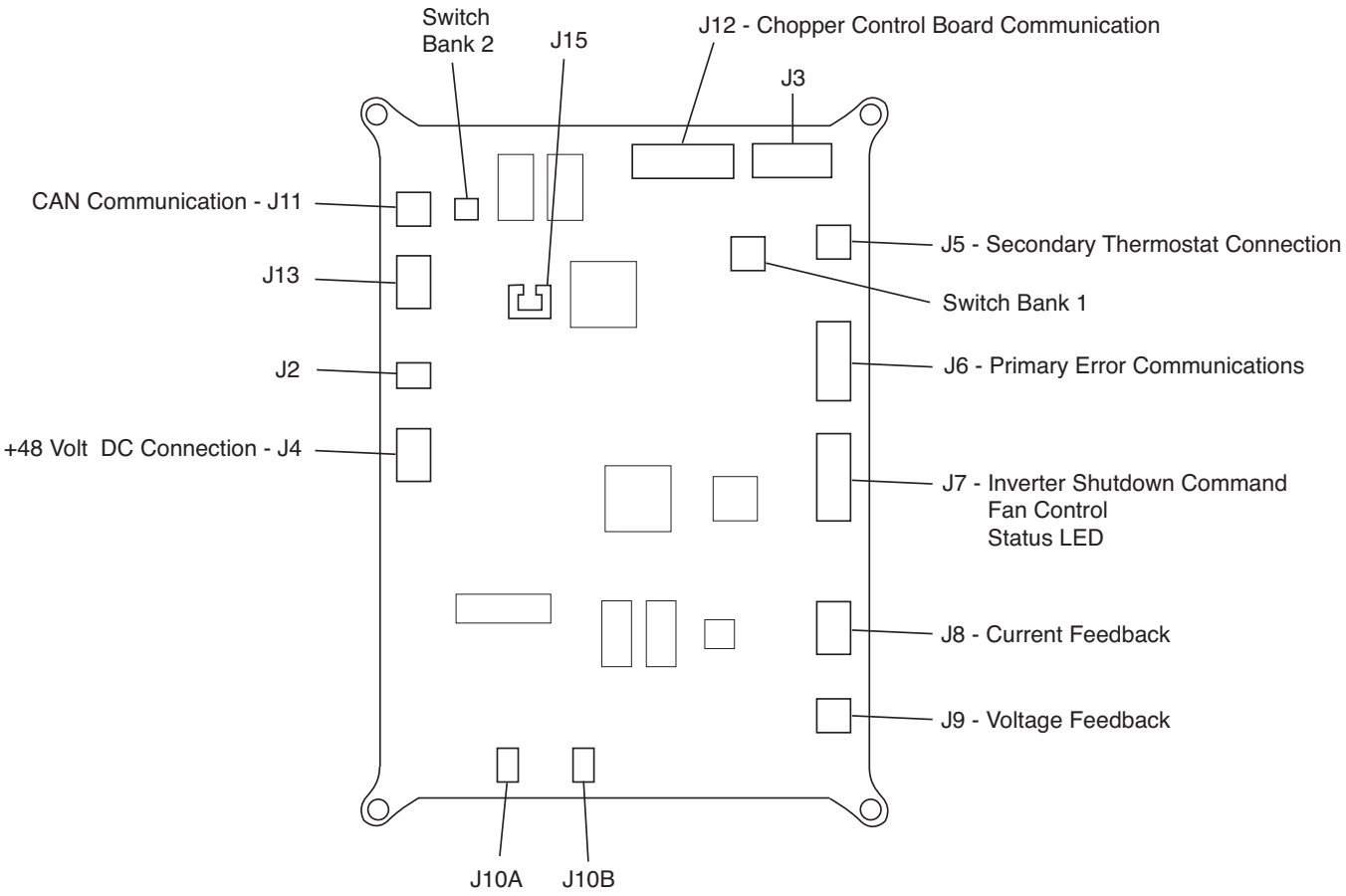
PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. To gain access to the Control Board see the ***Case Cover Removal and DC Link Capacitor Discharge Procedure.*** Remove the right side case cover.
3. Locate the Control Board. See Figure F.30.
4. Remove the eight molex type plugs and the Ethernet cable from the board. Label locations for reassembly. ***See Figure F.31.***
5. Using the 3/8” wrench remove the four nuts securing the control board to the vertical baffle.
6. Install the new board and replace the molex type plugs and Ethernet cable previously removed.
7. Check the settings of the dip switch making sure they are the same as the old board
8. Replace the four nuts previously removed.
9. Replace the right case side cover. See the ***Case Cover Removal and DC Link Capacitor Discharge Procedure.***

Return to Section TOC
Return to Master TOC

CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.31 – BOARD PLUG REMOVAL



Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SWITCH BOARD ASSEMBLY
REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Switch Board. **It is very important to make sure the Power Factor Control Board is not damaged before replacing the Switch Board. Perform the *Power Factor Control Board Test*.**

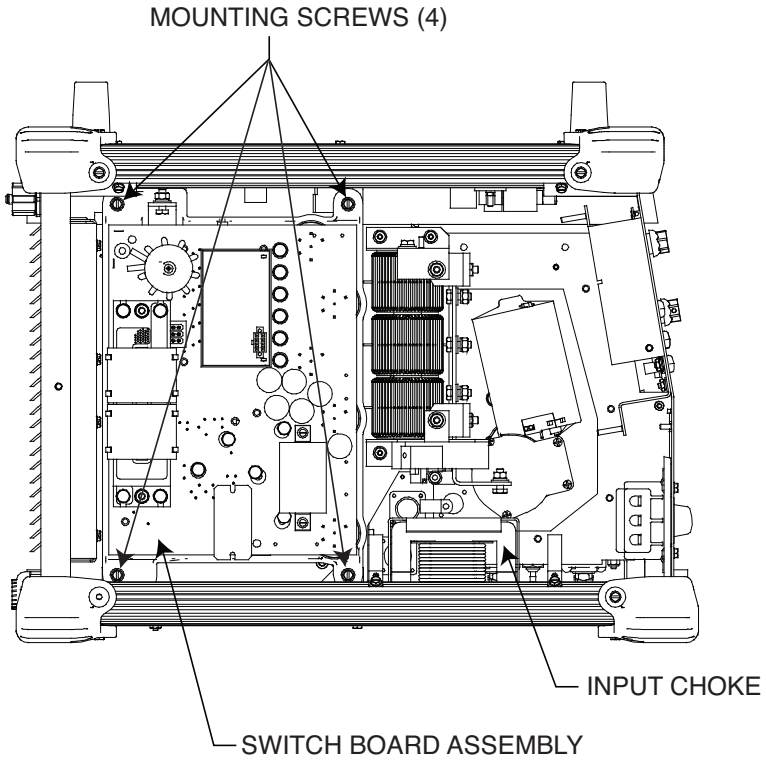
MATERIALS NEEDED

5/16” Nutdriver
7/16” Wrench
3/8” Nutdriver

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SWITCH BOARD ASSEMBLY
REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.32 – SWITCH BOARD LOCATION & MOUNTING SCREWS



PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. To gain access to the Switch Board Assembly see the ***Case Cover Removal and DC Link Capacitor Discharge Procedure.***
3. Locate the Switch Board. See Figure F.32.
4. Locate, label and remove the five molex plugs from the switch board. J41, J42, J43, J45 and J28. ***See Figure F.33.***
5. Using the 7/16” wrench, remove the six output choke leads from the terminals labeled BL1 thru BL6. Be sure to label the leads for reassembly. ***See Figure F.33.***
6. Using the 7/16” wrench, remove the positive output cable from the switch board. See ***Figure F.33.*** Note washer and lead placement for reassembly.
7. Using the 7/16” wrench, remove the two input choke leads from terminals B28 and B29. See ***Figure F.33.***
8. Using the 7/16” wrench, remove the three input power leads from terminals B30 Lead 2A, B31 Lead 1A and B32 Lead 3A. ***See Figure F33.***
9. Remove the two thermostat leads (410 and 409) from the heat sink thermostat. ***See Figure F.33***.
10. Using the 5/16” nutdriver, remove the four screws and washers securing the switch board assembly to the chassis frame. See Figure F.32.

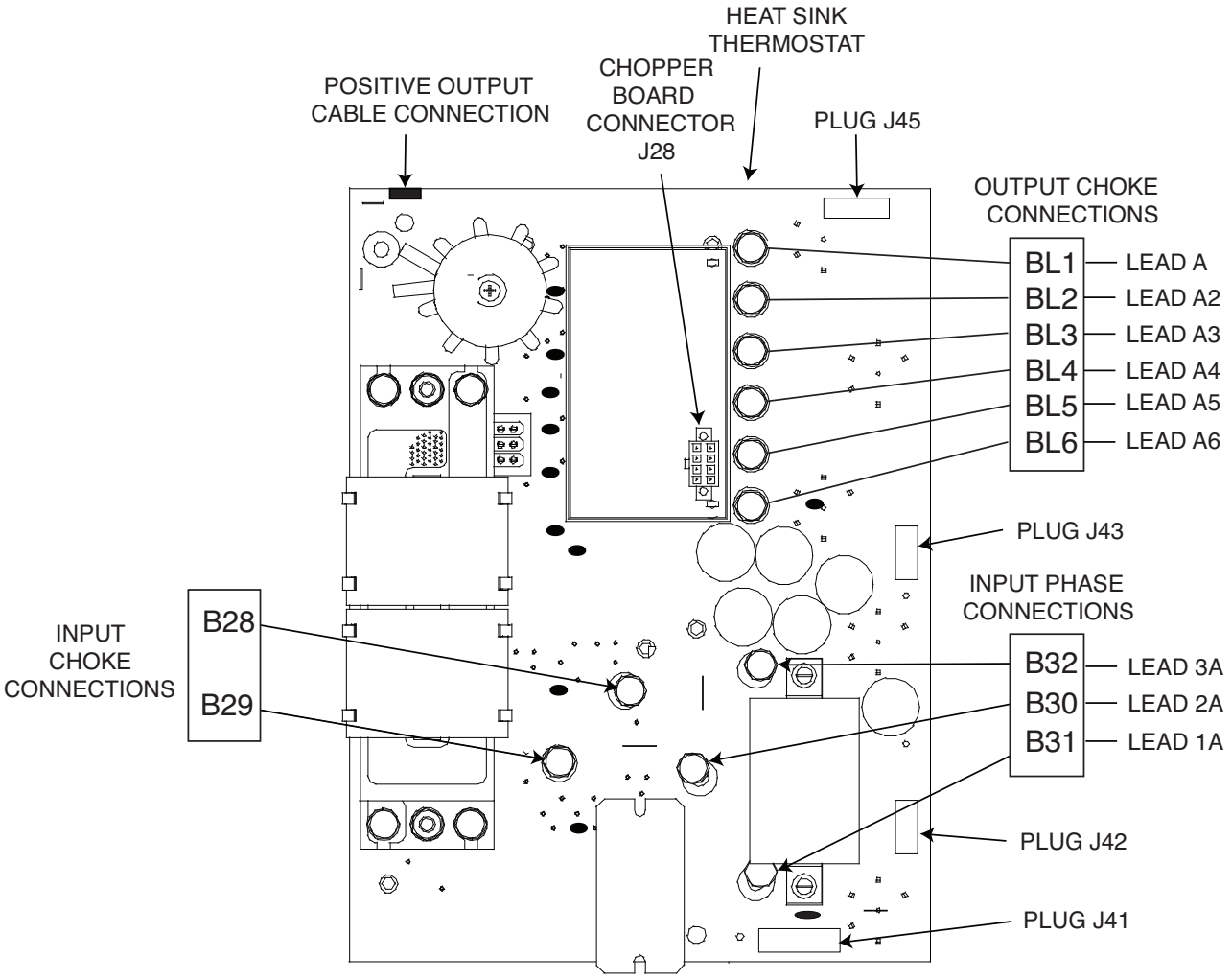
NOTE: To gain access to the rear mounting screws remove the air baffle.

11. Carefully remove the Switch Board Assembly.

Return to Section TOC
Return to Master TOC

SWITCH BOARD ASSEMBLY
REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.33 – SWITCH BOARD LEADS



12. Carefully place the new Switch Board Assembly into position in the chassis.
13. Secure the Switch Board Assembly to the chassis with the four screws and washers previously removed.
14. Replace the air baffle.
15. Connect leads 410 and 409 to the heat sink thermostat.
16. Reconnect the positive output cable.
17. Reconnect all of the leads previously removed. See Figure F.33.
18. Replace the five molex plugs previously removed. See Figure F.33.
19. Clear and position all leads.
20. Replace the case cover. See the ***Case Cover Removal and DC Link Capacitor Discharge Procedure.***
21. Perform the ***Retest After Repair Procedure.***

Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

DC BUS BOARD REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the DC Bus Board.

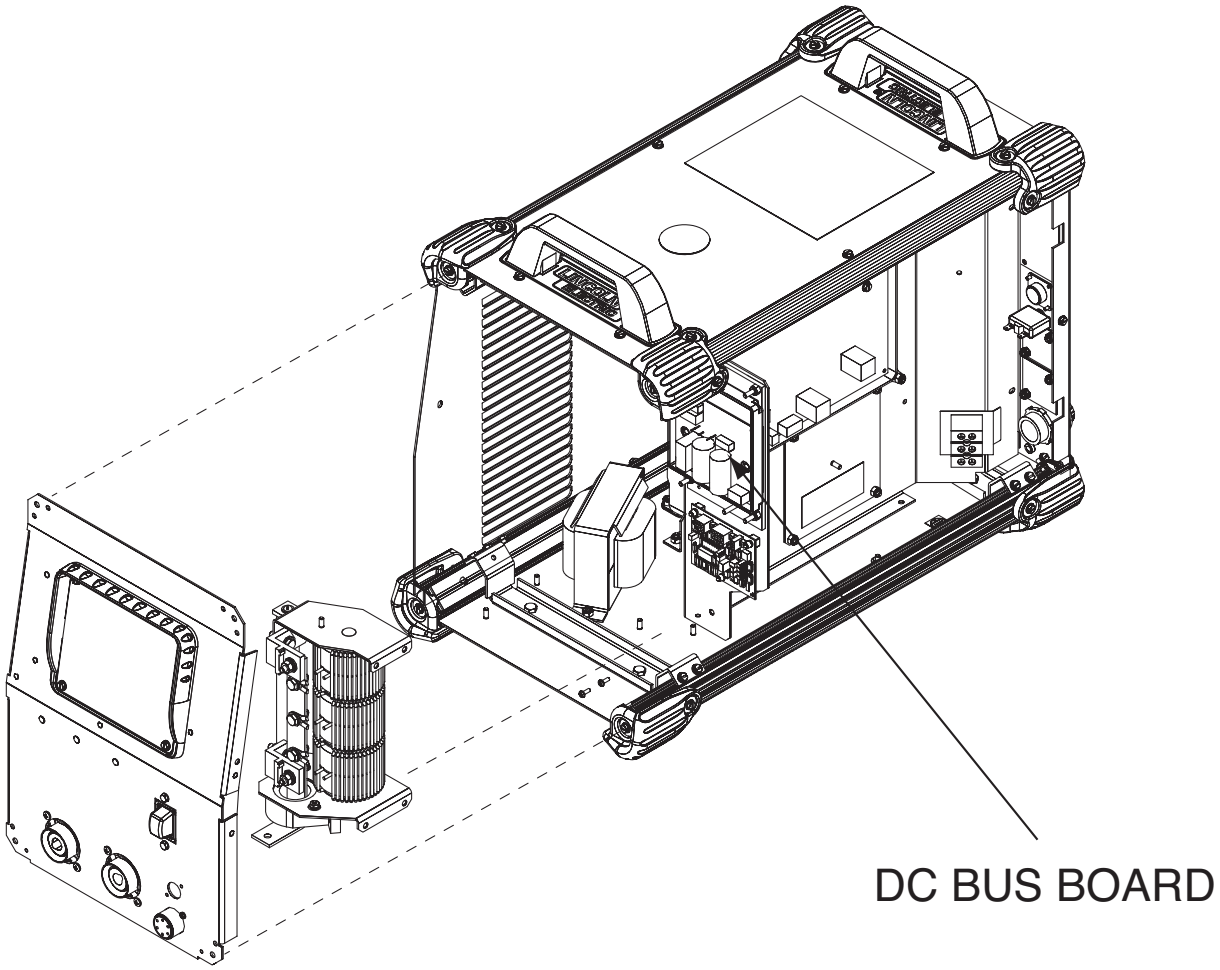
MATERIALS NEEDED

3/8" wrench

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

DC BUS BOARD REMOVAL AND REPLACEMENT (continued)

FIGURE F.34 – DC BUS BOARD LOCATIONS



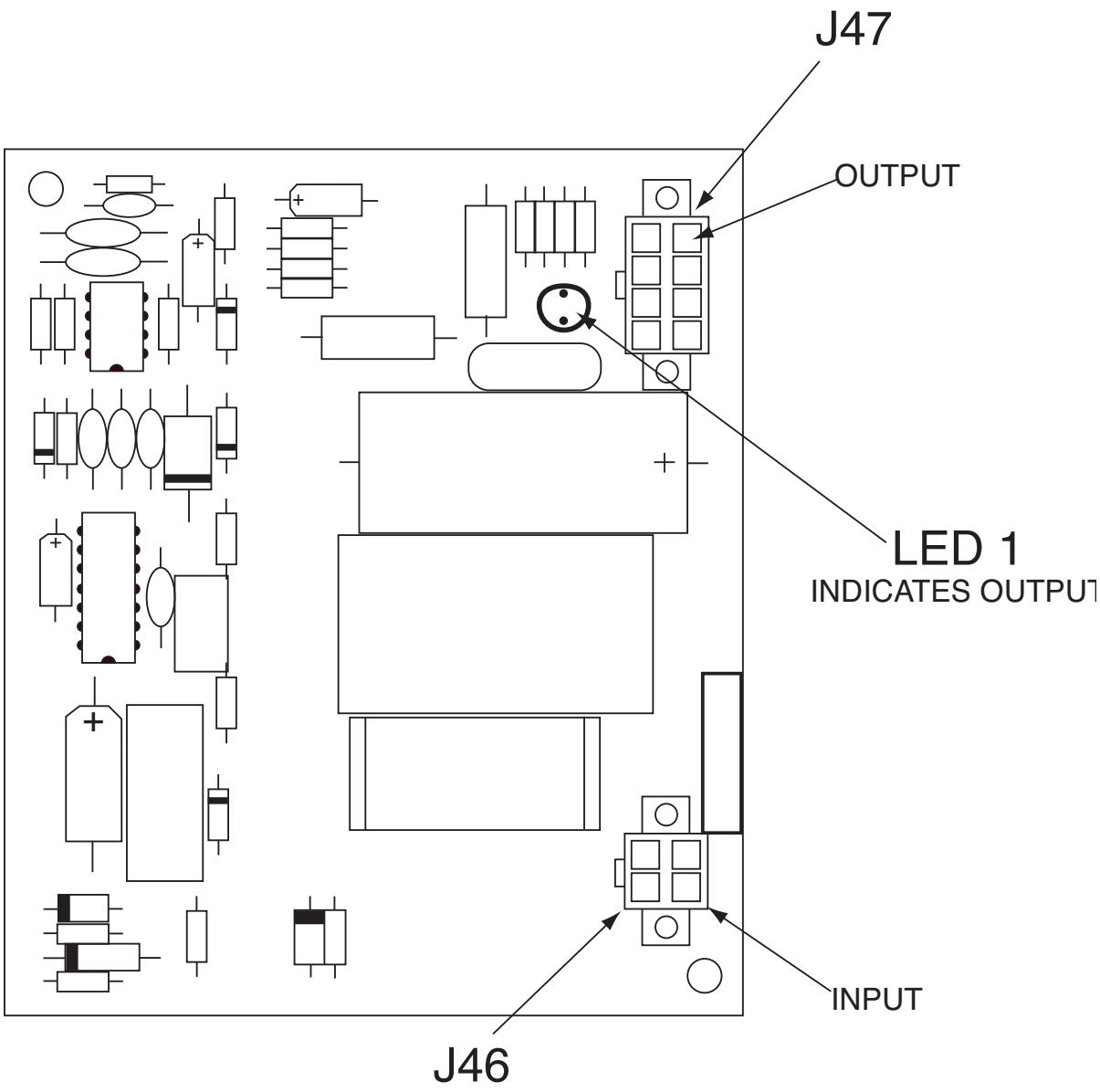
PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. To gain access to the DC Bus Board see the ***Case Cover Removal and DC Link Capacitor Discharge Procedure***. Remove the right case cover.
3. Locate the DC Bus Board. See Figure F.34.
4. Label and remove the two molex plugs from the DC Bus Board. ***See Figure F.35***.
5. Using the 3/8" wrench remove the four nuts securing the DC Bus Board to the vertical divider panel.
6. Carefully remove the DC Bus Board from the four mounting studs.
7. Install the new DC Bus Board onto the mounting studs.
8. Secure with the four nuts previously removed.
9. Install the two molex plugs.

Return to Section TOC
Return to Master TOC

DC BUS BOARD REMOVAL AND REPLACEMENT (continued)

FIGURE F.35 – DC BUS BOARD LOCATIONS



Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

REMOTE PC BOARD REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Remote PC Board.

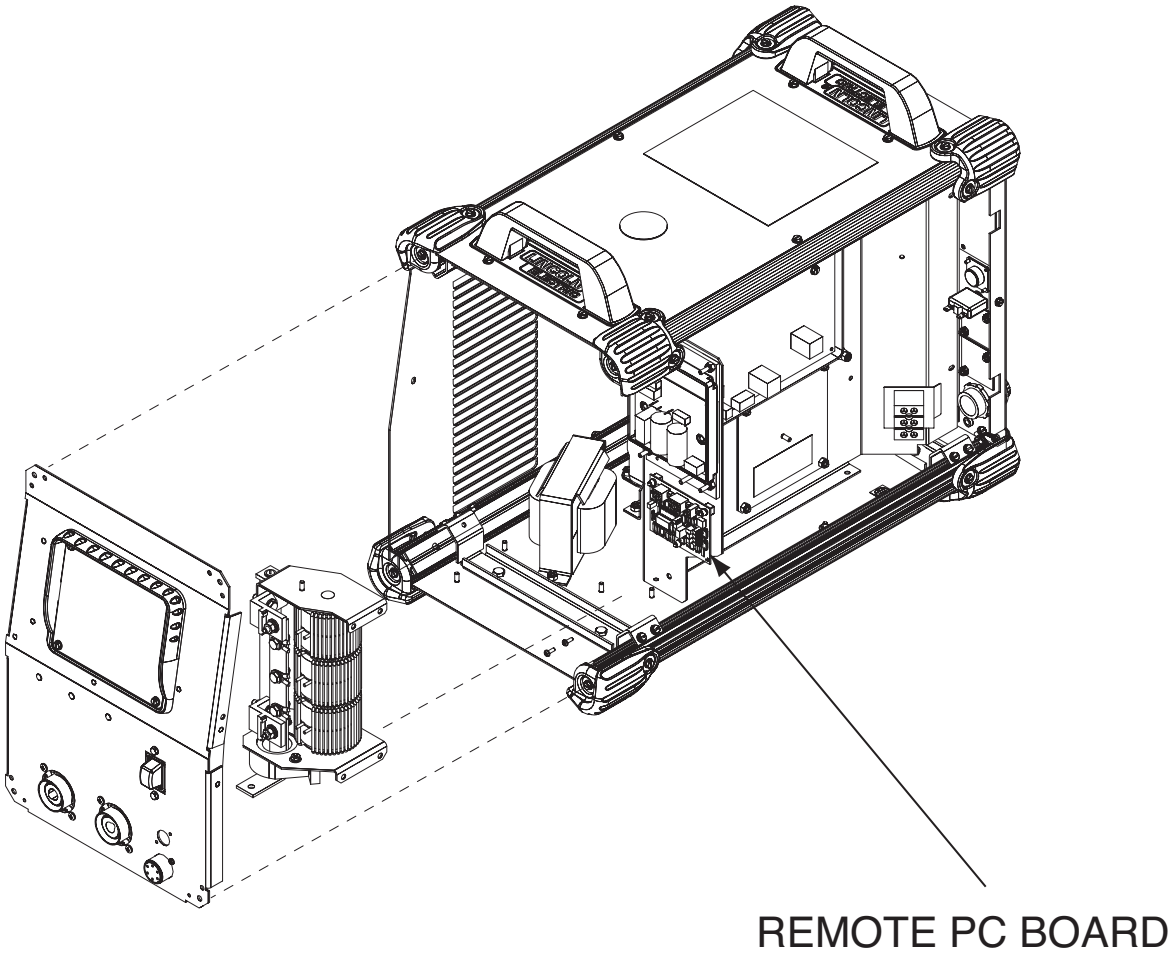
MATERIALS NEEDED

Phillips Head Screwdriver

Return to Section TOC
Return to Master TOC

REMOTE PC BOARD REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.36 – REMOTE PC BOARD LOCATIONS



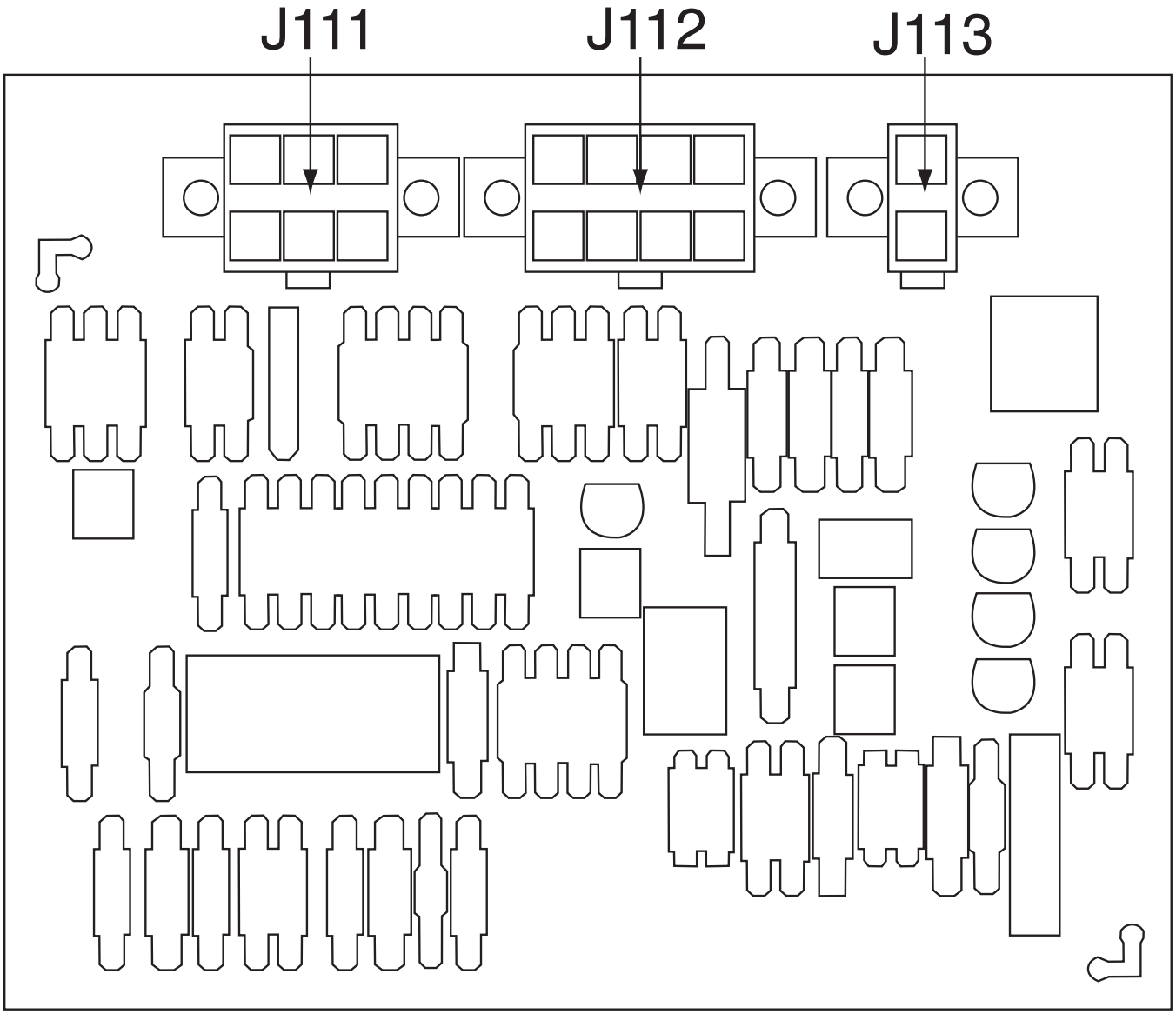
PROCEDURE

1. Disconnect the input power to the Power Wave S350 machine.
2. To gain access to the Remote PC Board see the ***Case Cover Removal and DC Link Capacitor Discharge Procedure***. Remove the right case cover.
3. Locate the Remote PC Board. See Figure F.36.
4. Label and remove the two molex plugs from the Remote PC Board. ***See Figure F.37***.
5. Using the phillips head screwdriver remove the three screws securing the Remote PC Board to the vertical divider panel.
6. Carefully remove the Remote PC Board.
7. Install the new DC Board onto the mounting studs.
8. Using the three screws previously removed mount the Remote PC Board to the vertical divider panel.
9. Install the two molex plugs.

Return to Section TOC
Return to Master TOC

REMOTE PC BOARD REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.37 – REMOTE PC BOARD LOCATIONS



Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

NOTES

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

RETEST AFTER REPAIR

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in testing the Power wave S350 output after the repair or replacement of a part or PC board.

MATERIALS NEEDED

Diagnostic Utilities Software
Laptop or other Suitable Computer
Ethernet Cross Connect Cable (LE Co. #M19969-7)
Resistive Load Bank
Two (2) Welding Cables - 20ft. -4/0
Calibrated Ammeter and Voltmeter

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

RETEST AFTER REPAIR (continued)

PROCEDURE

1. Be certain that the machine is properly connected for the input voltage being applied.

2. Turn the Power Switch ON and see that it goes through the Start-up routine and the Status Light is steady Green.

3. Turn the Power Switch OFF and connect a resistive load across the Output Studs and a computer to the Ethernet. ***Perform the Calibration Procedure*** to be sure that the machine will produce proper weld output.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

TABLE OF CONTENTS - DIAGRAM SECTION

Electrical Diagrams G-1

Wiring Diagram - Complete Machine (G6536) G-2

Schematic – Complete Machine (G6535) G-3, G-4

Schematic – Digital Control PC Board (G4799) . . . . . .G-5 thru G-17

Schematic - 3 Stage Inverter PC Board (G4769) G-18, G-19

Schematic – Control and Power Supply PC Board (G5914) . . . . . .G-20 thru G-22

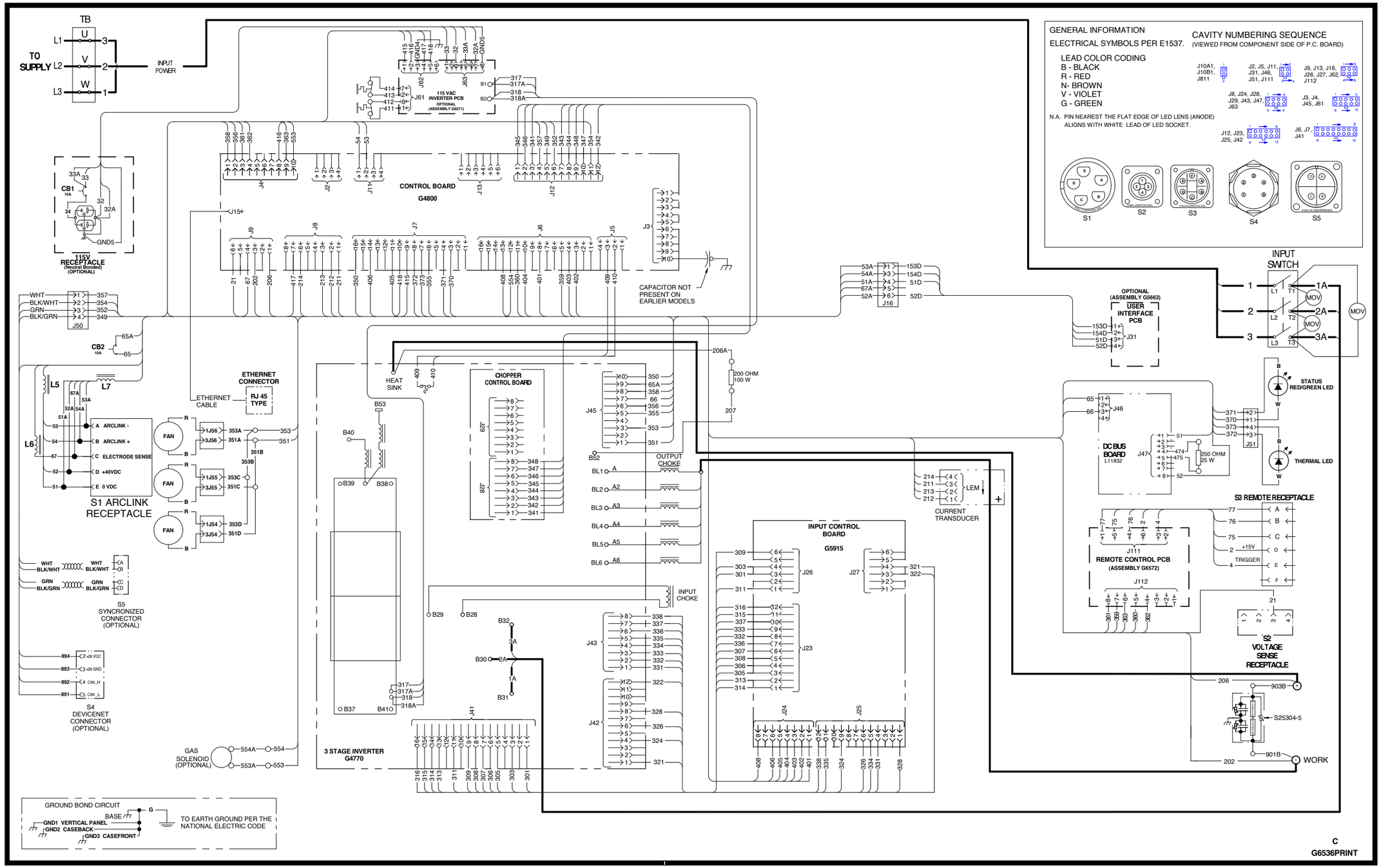
Schematic – 40 VDC Buss Power Supply PC Board (M19330) G-23

*** NOTE:** Many PC Board Assemblies are now totally encapsulated, surface mounted and or multi-layered and are therefore considered to be unserviceable. Assembly drawings of these boards are no longer provided.

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

WIRING DIAGRAM - COMPLETE MACHINE (G6536)

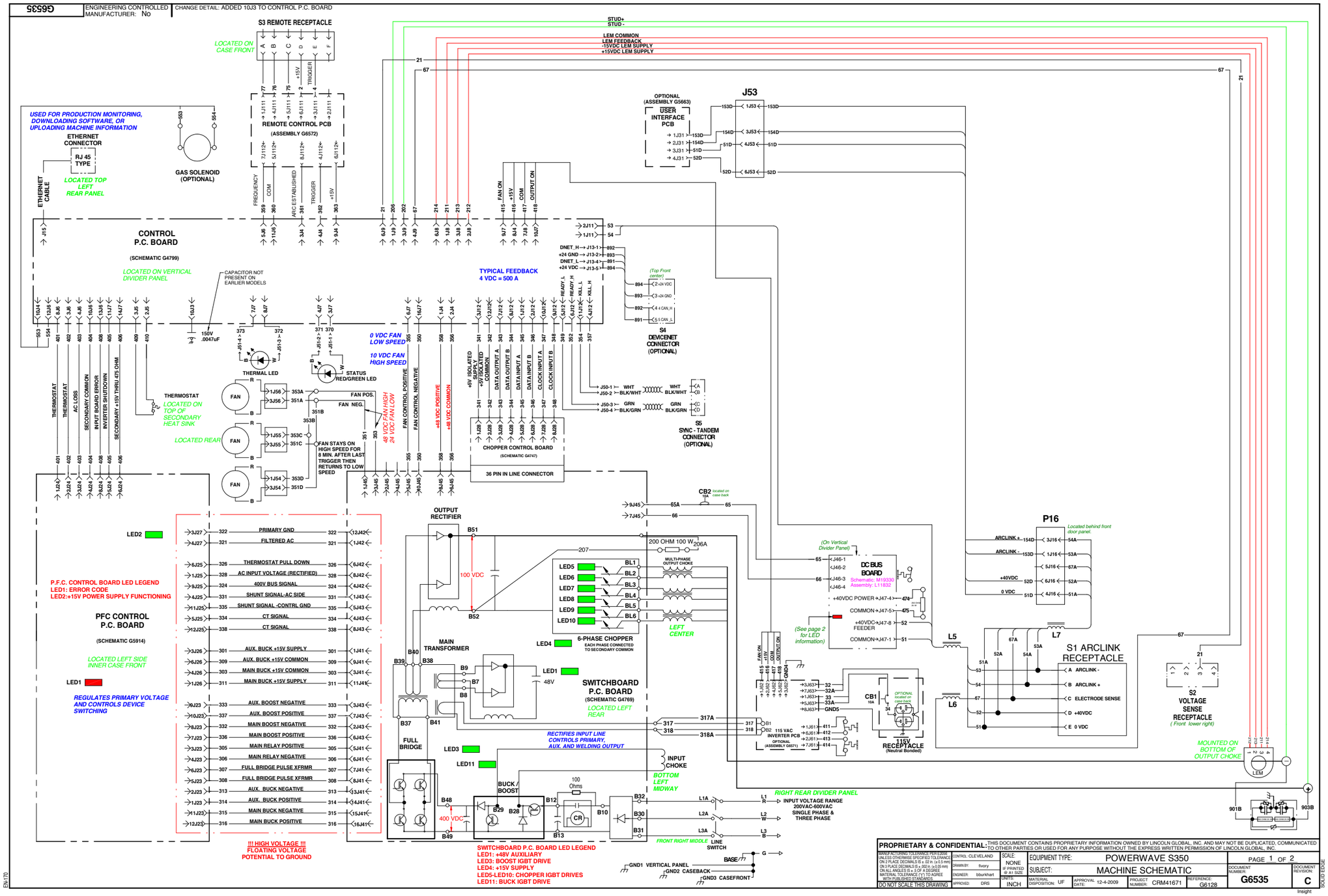
POWER WAVE S350



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The wiring diagram specific to your code is pasted inside one of the enclosure panels of your machine.

Return to Section TOC
Return to Master TOC

SCHEMATIC - COMPLETE MACHINE (G6535 PG 1)



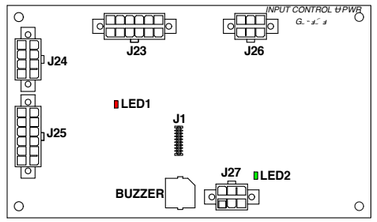
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SCHEMATIC - COMPLETE MACHINE (G6535 PG 2)

G6535 | ENGINEERING CONTROLLED | CHANGE DETAIL- ADDED J111 TO CONTROL P.C. BOARD
MANUFACTURER- No

PFC CONTROL P.C. BOARD

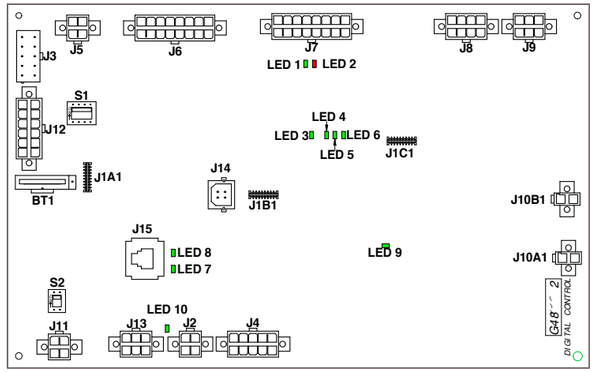


Description of LED functions on Power Wave S350
For reference only

G5915 PFC CONTROL P.C. BOARD		
LED	COLOR	FUNCTION
2	GREEN	24 VDC POWER SUPPLY FUNCTIONING PROPERLY WHEN ON
1	RED	ERROR CODE (LED WILL FLASH ERROR AND BUZZER WILL SOUND) SEE TABLE BELOW FOR DETAILS

ERROR CODE	
ERROR	EXPLANATION
111	PEAK INPUT CURRENT LIMIT
114	START UP CURRENT CHECK FAILURE
115	START UP VOLTAGE CHECK FAILURE
121	THERMAL FAULT (NO FIRST STAGE FAN)
122	PRECHARGE TIMEOUT
124	TRANSFORMER PRIMARY OVERCURRENT

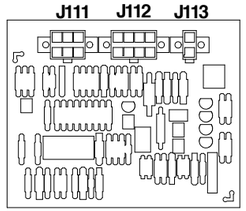
CONTROL P.C. BOARD



Description of LED functions on Power Wave S350 ***For reference only***

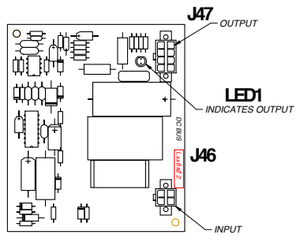
G4800 CONTROL P.C. BOARD		
LED	COLOR	FUNCTION
1	GREEN	STATUS (OK)
2	RED	STATUS (ERROR) (CHECK CODE FOR SPECIFIC ERROR)
3	GREEN	OUTPUT ENABLE
4	GREEN	SINGLE PHASE DETECT
5	GREEN	+5 SENSE
6	GREEN	+24 SENSE
7	GREEN	ETHERNET STATUS
8	GREEN	ETHERNET STATUS
9	GREEN	INPUT SUPPLY 18 VDC TO 55 VDC
10	GREEN	DEVICENET

REMOTE BOARD
ASSEMBLY G5672-1



NO P.C. BOARD MOUNTED LED's

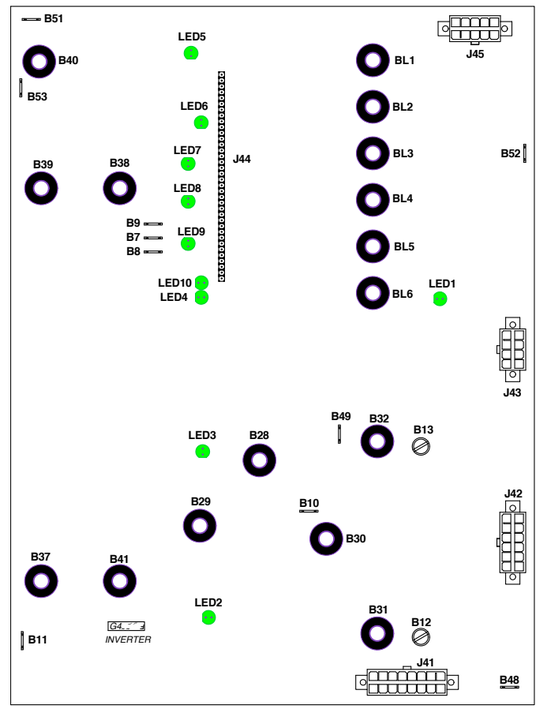
DC BUS BOARD



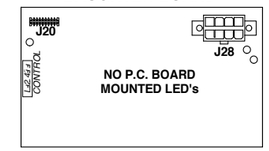
SWITCHBOARD P.C. BOARD

Description of LED functions on Power Wave S350
For reference only

G4770 SWITCHBOARD P.C. BOARD		
LED	COLOR	FUNCTION
1	GREEN	48 VDC AUXILIARY POWER FUNCTIONING WHEN ON
2	GREEN	BOOST IGBT DRIVE FUNCTIONING WHEN ON
4	GREEN	24 VDC POWER FUNCTIONING PROPERLY WHEN ON
5	GREEN	CHOPPER IGBT 1 DRIVE FUNCTIONING WHEN ON
6	GREEN	CHOPPER IGBT 2 DRIVE FUNCTIONING WHEN ON
7	GREEN	CHOPPER IGBT 3 DRIVE FUNCTIONING WHEN ON
8	GREEN	CHOPPER IGBT 4 DRIVE FUNCTIONING WHEN ON
9	GREEN	CHOPPER IGBT 5 DRIVE FUNCTIONING WHEN ON
10	GREEN	CHOPPER IGBT 6 DRIVE FUNCTIONING WHEN ON
11	GREEN	BUCK IGBT DRIVE FUNCTIONING WHEN ON



CHOPPER CONTROL DAUGHTER BOARD



NO P.C. BOARD MOUNTED LED's

PROPRIETARY & CONFIDENTIAL- THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OWNED BY LINCOLN GLOBAL INC. AND MAY NOT BE DUPLICATED COMMUNICATED TO OTHER PARTIES OR USED FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF LINCOLN GLOBAL INC.

MANUFACTURING TOLERANCE PER CP
UNLESS OTHERWISE SPECIFIED TOLERANCE ON 2 PLACE DECIMALS IS ± .01 (± .25 mm) ON 4 PLACE DECIMALS IS ± .0 (± .13 mm) ON ALL ANGLES IS ± .5 DEGREE. MATERIAL TOLERANCE TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

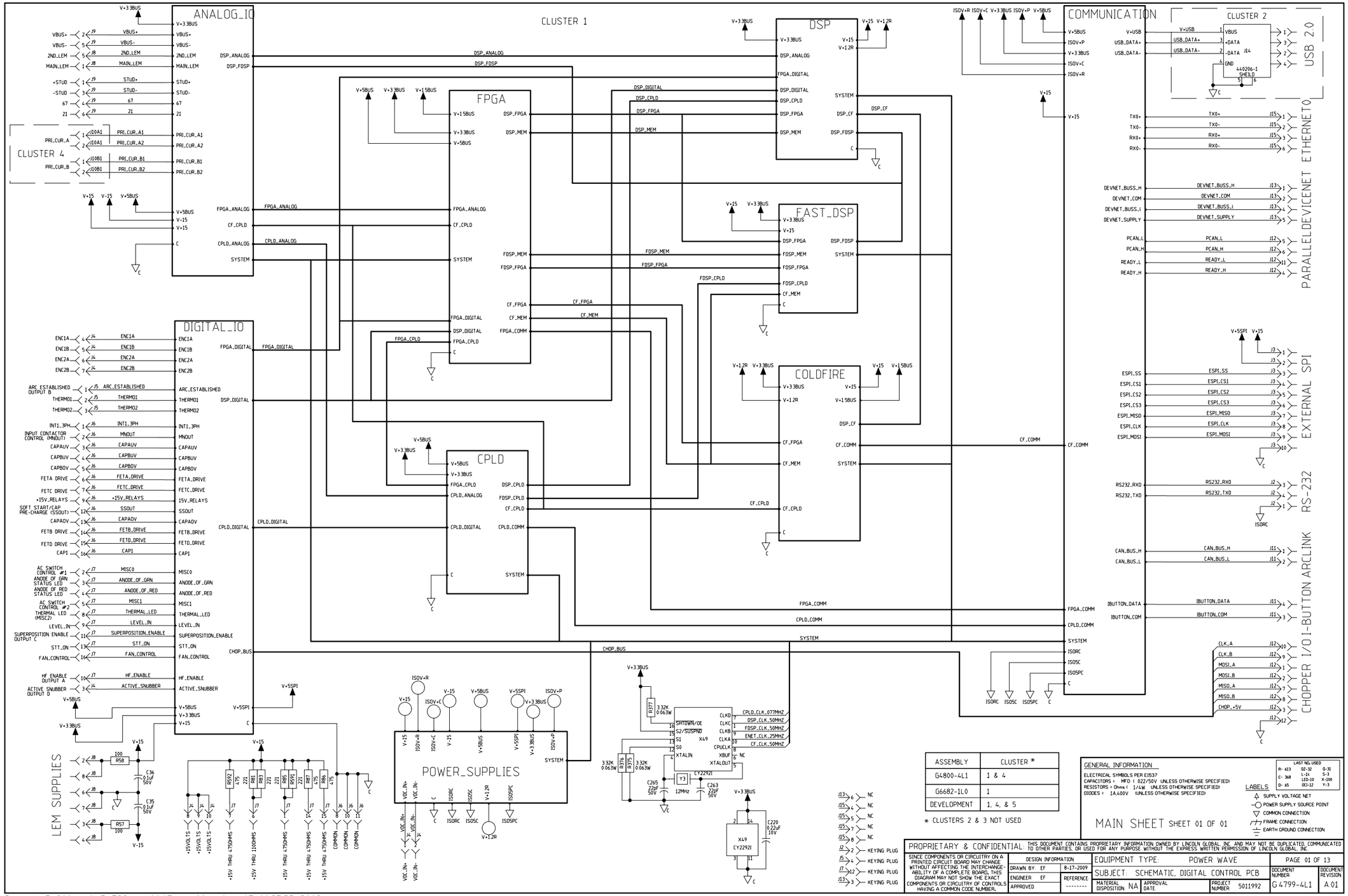
CONTROL- CLEVELAND	SCALE- NONE IF PRINTED SCALE	EQUIPMENT TYPE- POWERWAVE S350		PAGE 2 OF 2	
DRAWN BY- fivor		SUBJECT- MACHINE SCHEMATIC		DOCUMENT NUMBER- G6535	DOCUMENT REVISION- C
ENGINEER- bb*ikhart	UNITS- INCH	MATERIAL DISPOSITION- UF	APPROVAL DATE- 2 4 2	PROJECT NUMBER- CRM4	REFERENCE- G 28
APPROVED- DRS					

SOLID EDGE Insight

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

SCHEMATIC - DIGITAL CONTROL PC BOARD (G4799 PG 1)



ASSEMBLY	CLUSTER *
G4800-4L1	1 & 4
G6682-1L0	1
DEVELOPMENT	1, 4, & 5

* CLUSTERS 2 & 3 NOT USED

GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A 400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED
R- 453 D2-32 Q-31
C- 368 L-14 S-3
LED-10 U-100
D- 65 OC1-12 Y-3

LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

MAIN SHEET SHEET 01 OF 01

PROPRIETARY & CONFIDENTIAL: THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OWNED BY LINCOLN GLOBAL INC. AND MAY NOT BE DUPLICATED, COMMUNICATED TO OTHER PARTIES, OR USED FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF LINCOLN GLOBAL INC.

SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGE-ABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

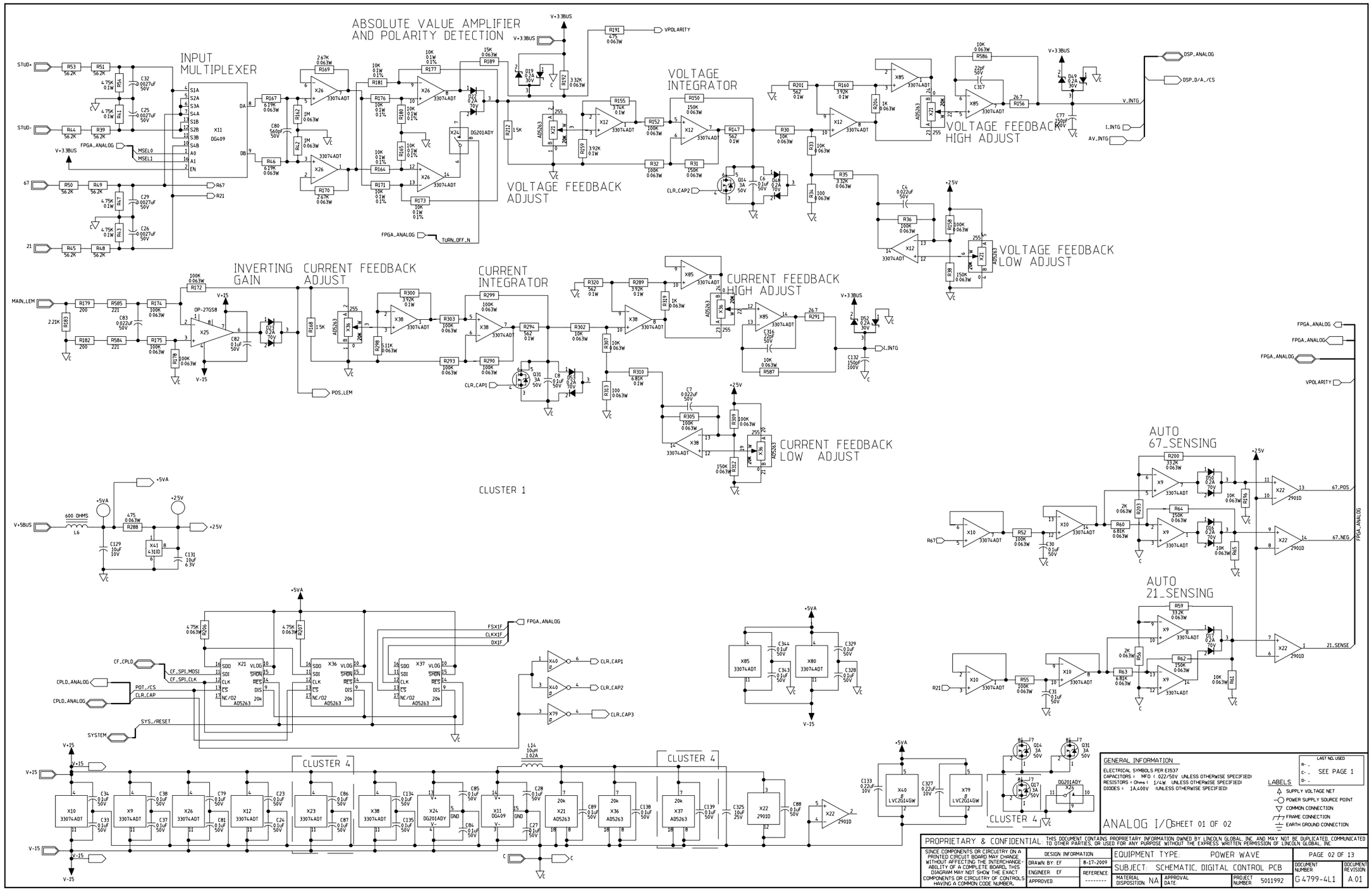
DESIGN INFORMATION		EQUIPMENT TYPE: POWER WAVE	PAGE 01 OF 13
DRAWN BY: EF	8-17-2009	SUBJECT: SCHEMATIC, DIGITAL CONTROL PCB	DOCUMENT NUMBER: G4799-4L1
ENGINEER: EF	REFERENCE: -------		DOCUMENT REVISION: A.01
APPROVED:	MATERIAL DISPOSITION: NA	APPROVAL DATE:	PROJECT NUMBER: 5011992

C:\Jobs\G4800-4L1\G4799.sbk(01,17) Mon Aug 17 11:25:33 2009

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

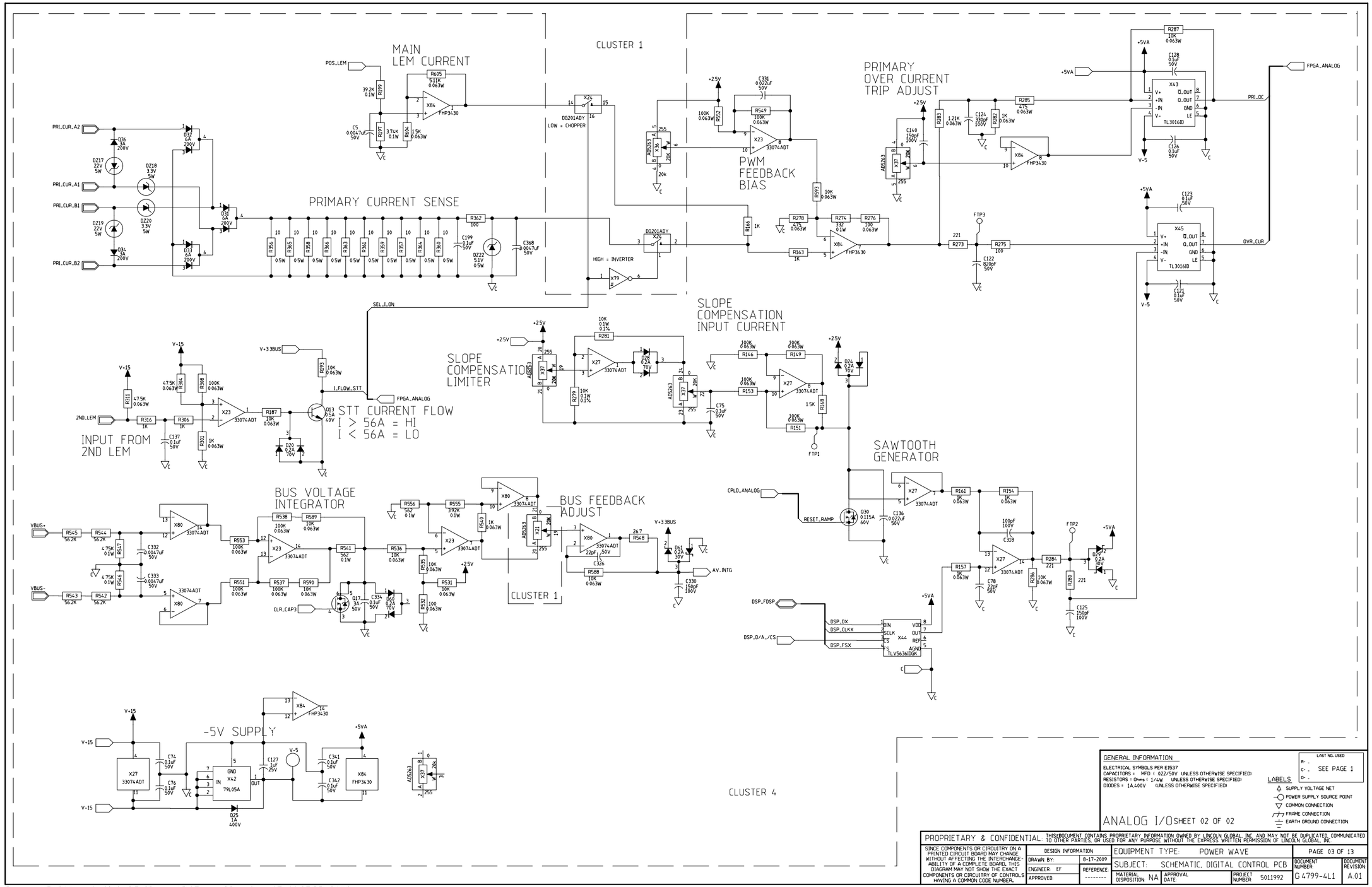
SCHEMATIC - DIGITAL CONTROL PC BOARD (G4799 PG 2)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SCHEMATIC - DIGITAL CONTROL PC BOARD (G4799 PG 3)



C:\Jobs\G4800-4L1\ANALOG_IO.sbk(03;17) Mon Aug 17 11:25:33 2009

GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A,400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED
R- .
C- . SEE PAGE 1
D- .

LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

ANALOG I/O SHEET 02 OF 02

PROPRIETARY & CONFIDENTIAL: THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OWNED BY LINCOLN GLOBAL, INC. AND MAY NOT BE DUPLICATED, COMMUNICATED TO OTHER PARTIES, OR USED FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF LINCOLN GLOBAL, INC.

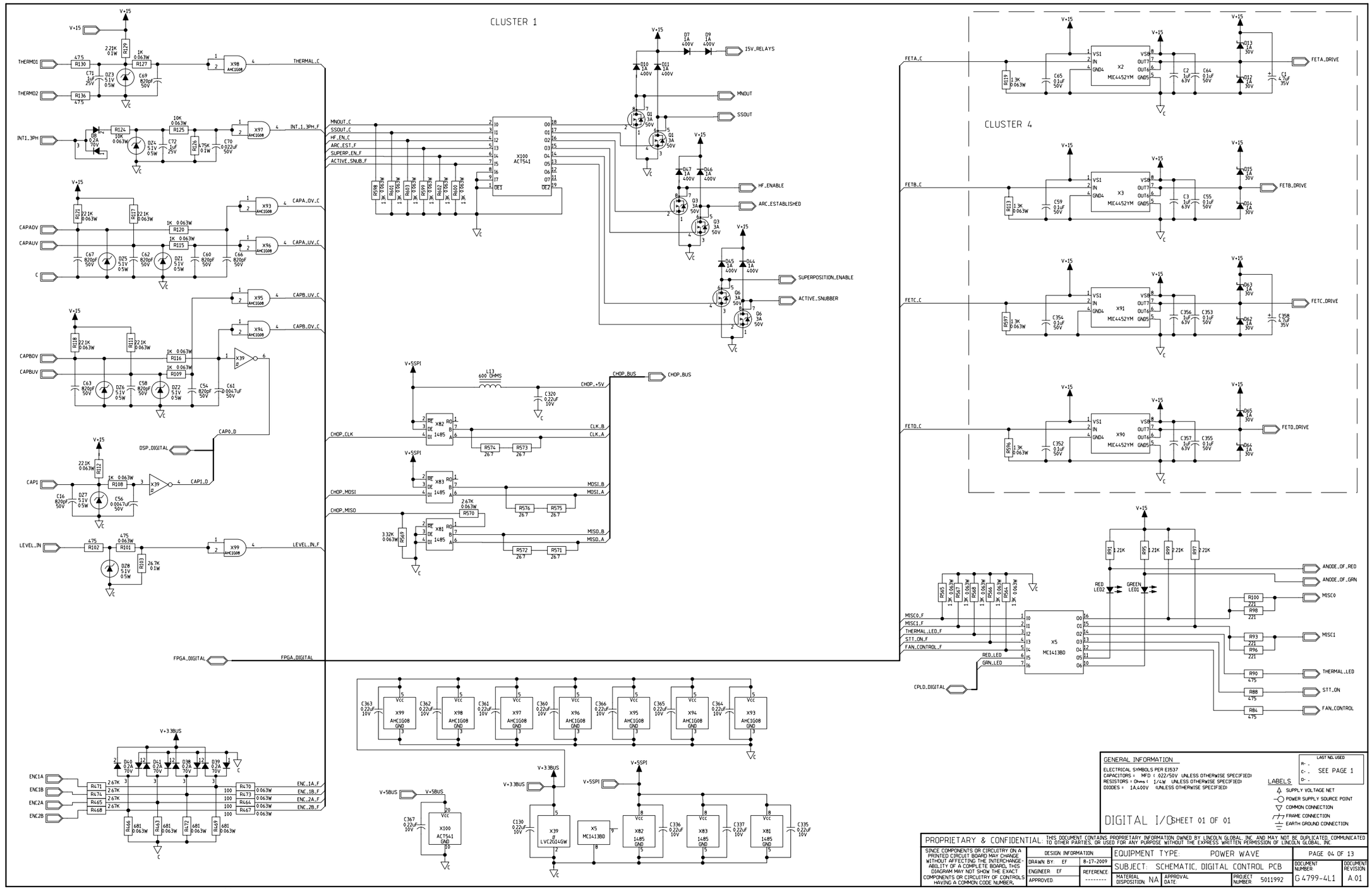
SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

DESIGN INFORMATION		EQUIPMENT TYPE: POWER WAVE	PAGE 03 OF 13	
DRAWN BY:	8-17-2009	SUBJECT: SCHEMATIC, DIGITAL CONTROL PCB	DOCUMENT NUMBER: G4799-4L1	DOCUMENT REVISION: A.01
ENGINEER: EF	REFERENCE: --------			
APPROVED:		MATERIAL DISPOSITION: NA APPROVAL DATE:	PROJECT NUMBER: 5011992	

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

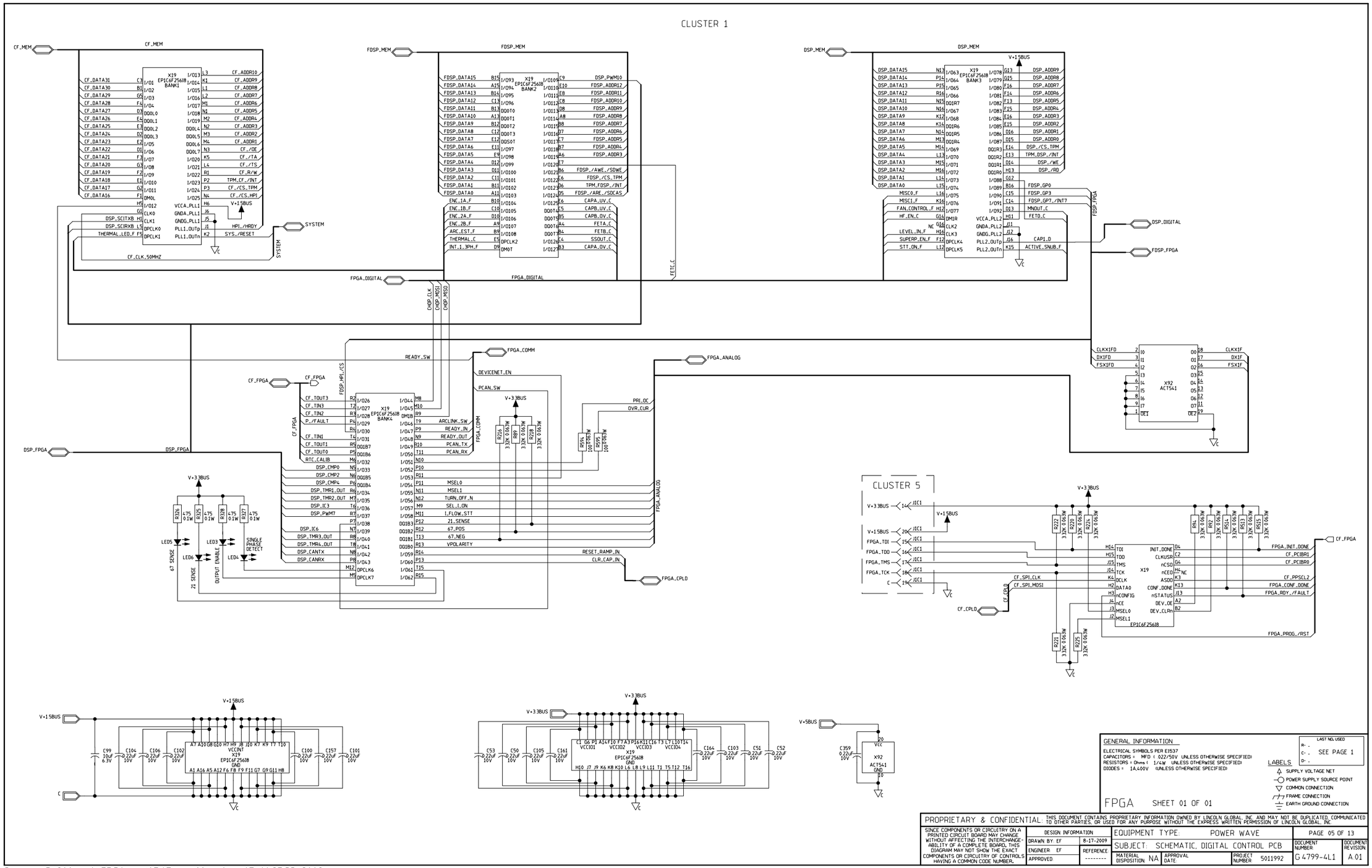
SCHEMATIC - DIGITAL CONTROL PC BOARD (G4799 PG 4)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SCHEMATIC - DIGITAL CONTROL PC BOARD (G4799 PG 5)

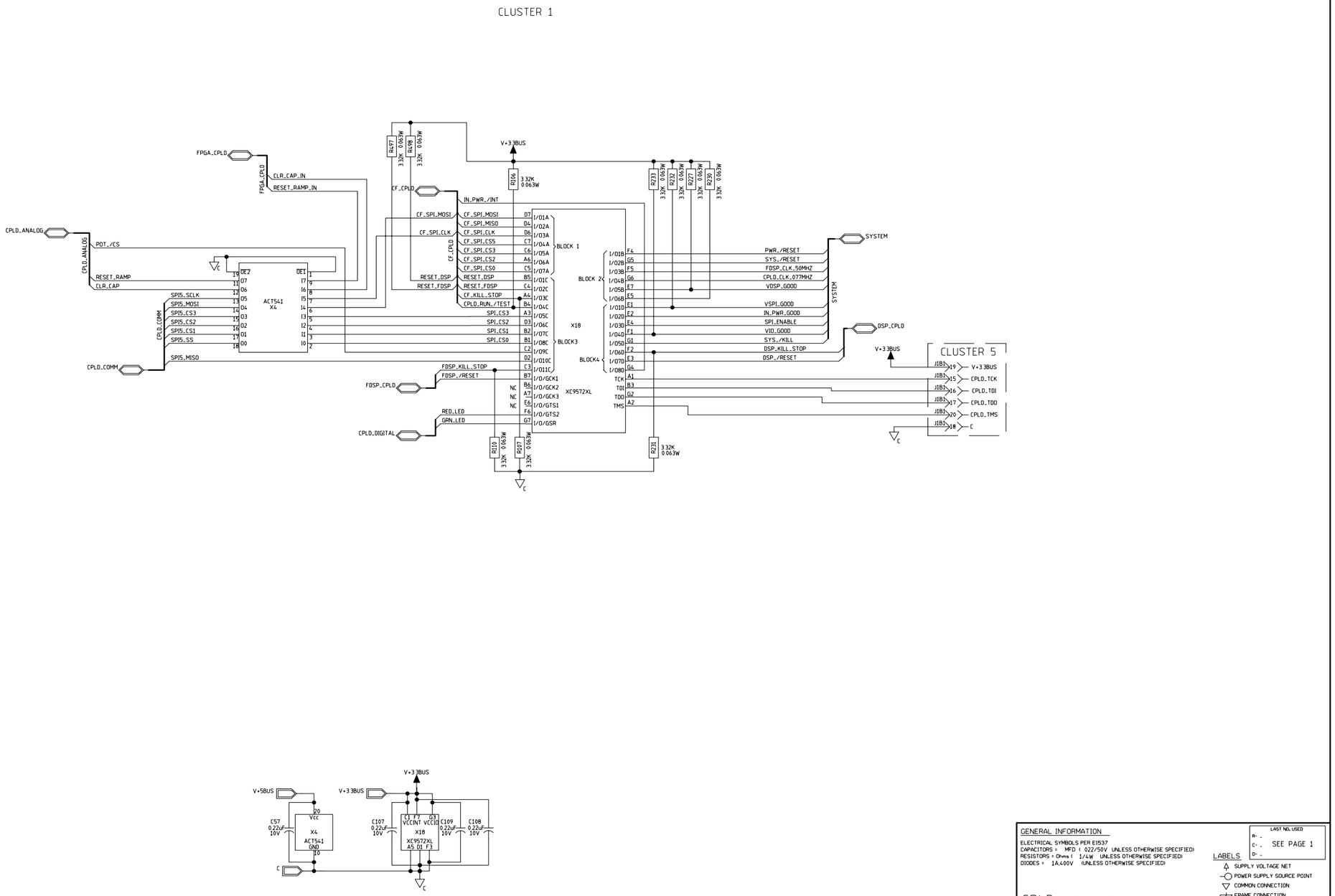


C:\Jobs\G4800-4L1\FPGA.sbk(05,17) Mon Aug 17 11:25:33 2009

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

SCHEMATIC - DIGITAL CONTROL PC BOARD (G4799 PG 6)



GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A,400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED
R- .
C- . SEE PAGE 1
D- .

LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

CPLD SHEET 01 OF 01

PROPRIETARY & CONFIDENTIAL: THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OWNED BY LINCOLN GLOBAL, INC. AND MAY NOT BE DUPLICATED, COMMUNICATED TO OTHER PARTIES, OR USED FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF LINCOLN GLOBAL, INC.

SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

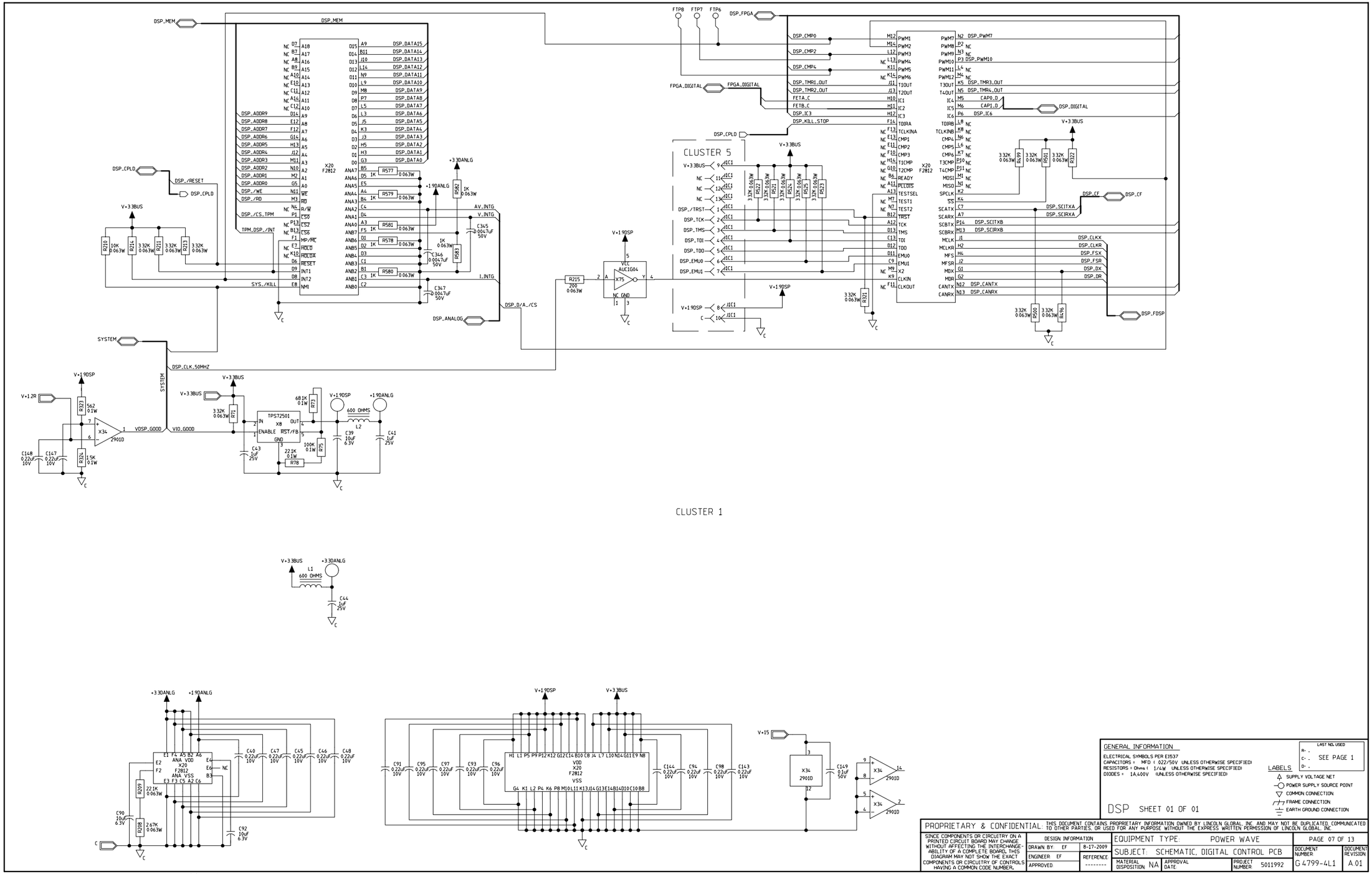
DESIGN INFORMATION			
DRAWN BY: EF	8-17-2009	EQUIPMENT TYPE: POWER WAVE	PAGE 06 OF 13
ENGINEER EF	REFERENCE --------	SUBJECT: SCHEMATIC, DIGITAL CONTROL PCB	DOCUMENT NUMBER G4799-4L1 / DOCUMENT REVISION A.01
APPROVED		MATERIAL DISPOSITION NA / APPROVAL DATE / PROJECT NUMBER 5011992	

C:\Jobs\G4800-4L1\CPLD.sbk(06;17) Mon Aug 17 11:25:34 2009

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

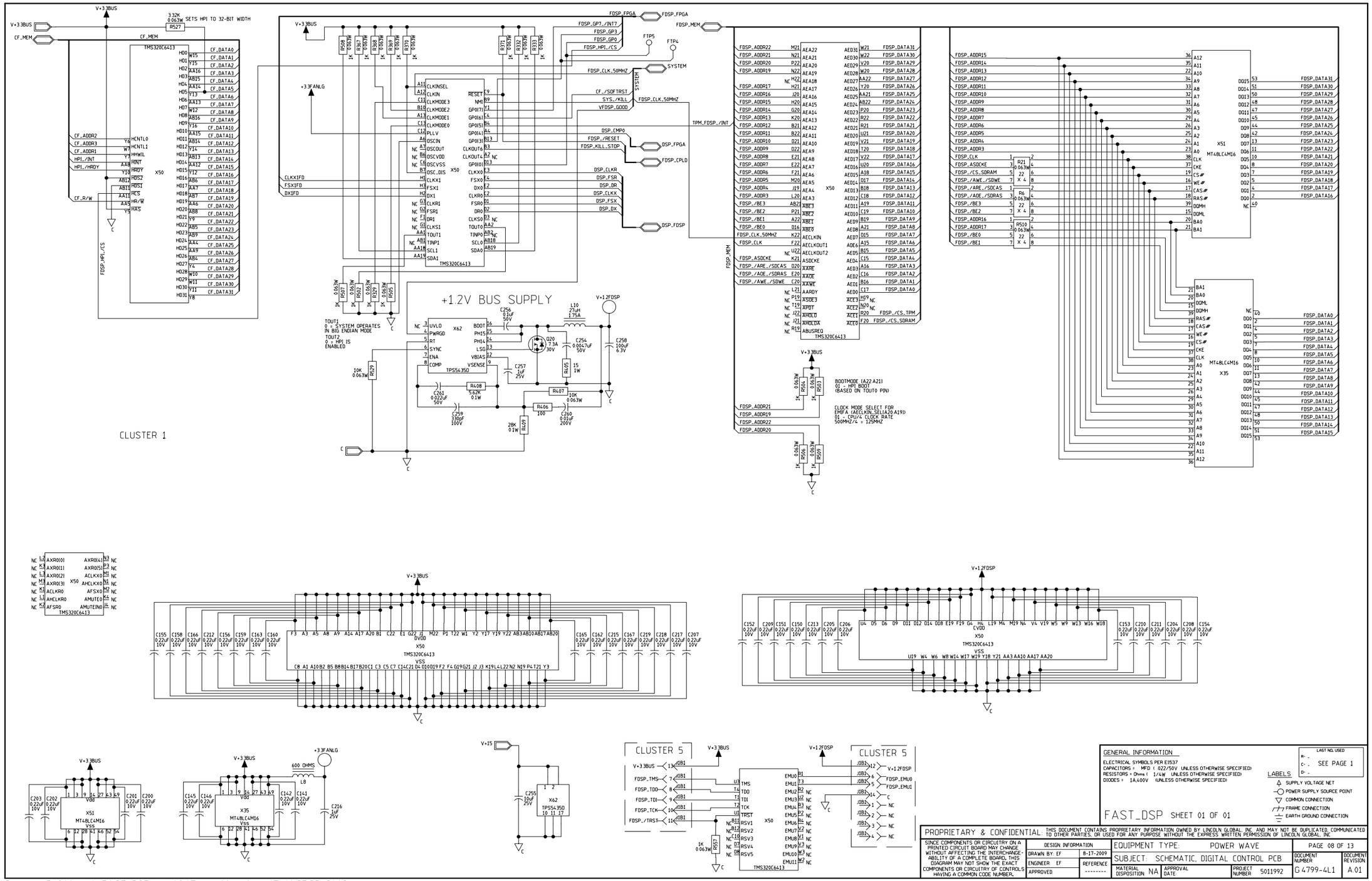
SCHEMATIC - DIGITAL CONTROL PC BOARD (G4799 PG 7)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

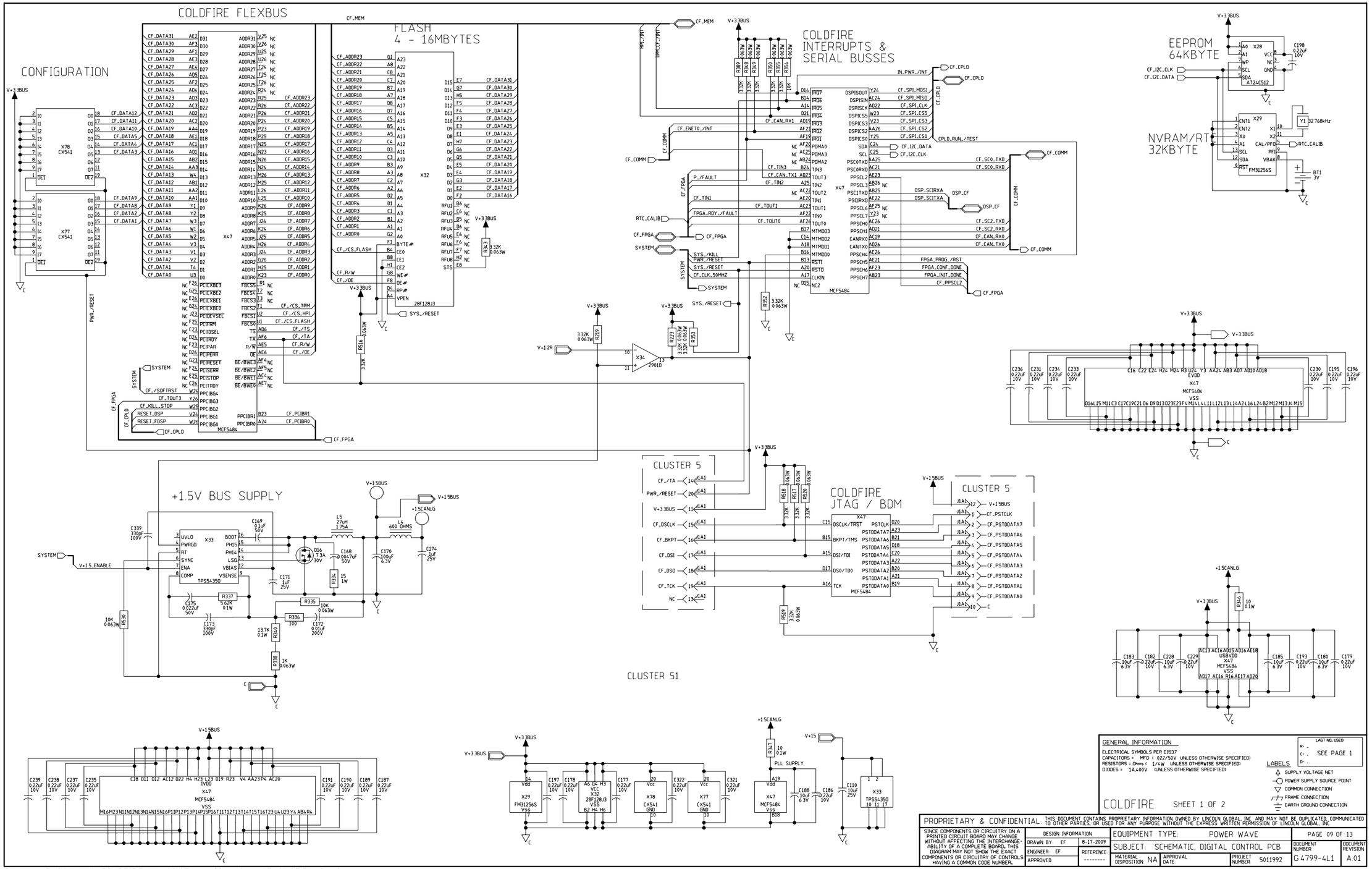
Return to Section TOC
Return to Master TOC

SCHEMATIC - DIGITAL CONTROL PC BOARD (G4799 PG 8)



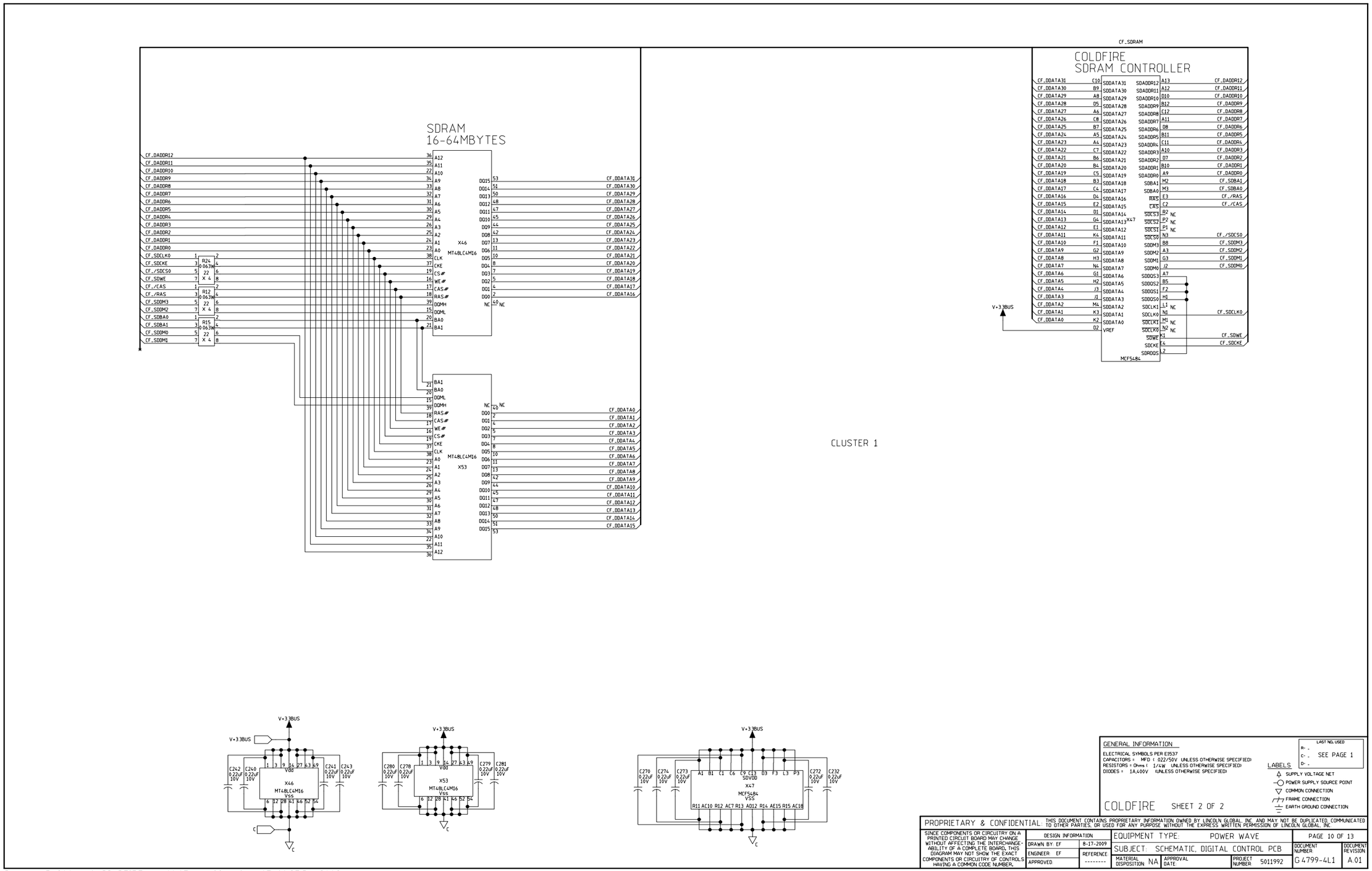
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - DIGITAL CONTROL PC BOARD (G4799 PG 9)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

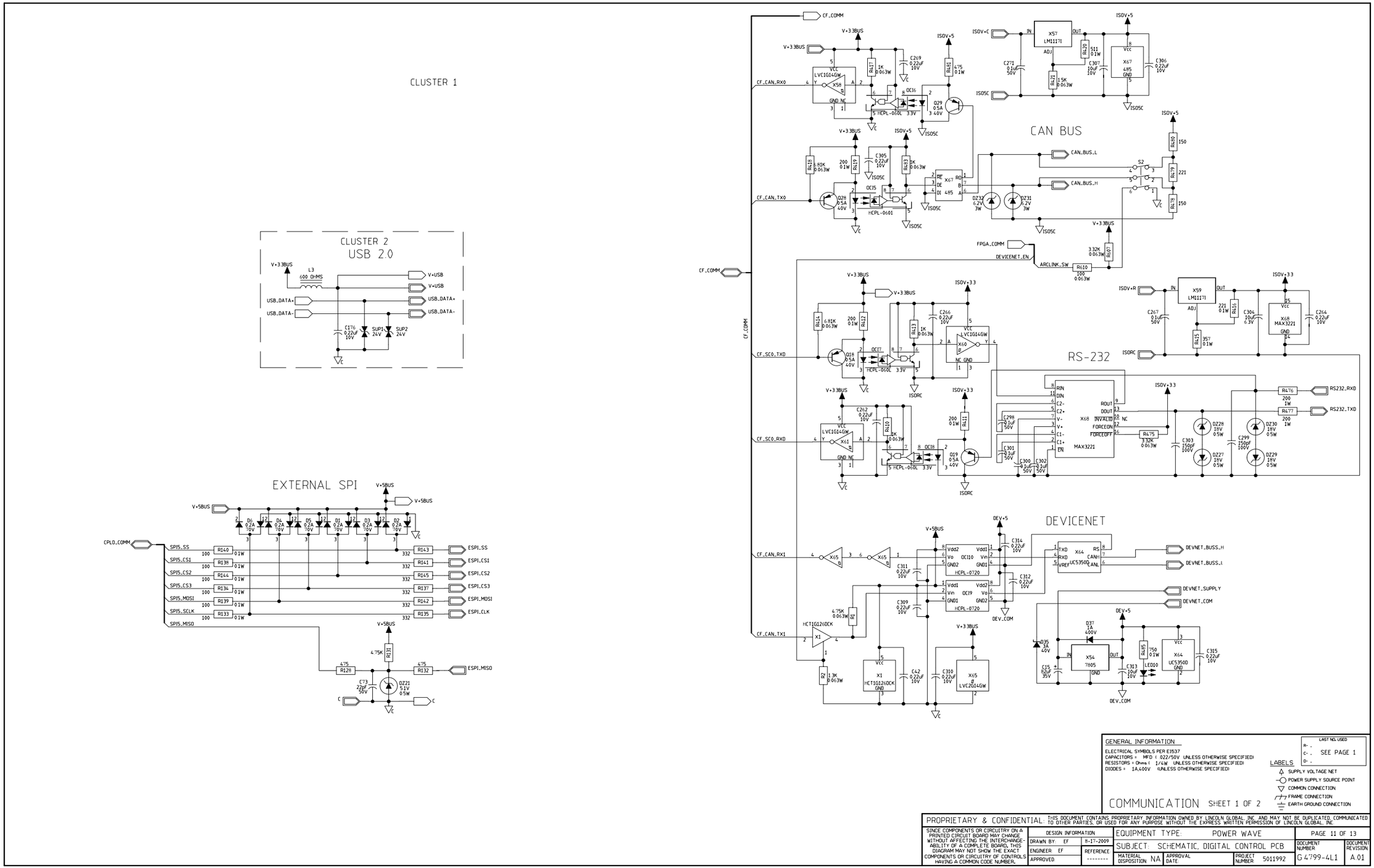
SCHEMATIC - DIGITAL CONTROL PC BOARD (G4799 PG 10)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

SCHEMATIC - DIGITAL CONTROL PC BOARD (G4799 PG 11)

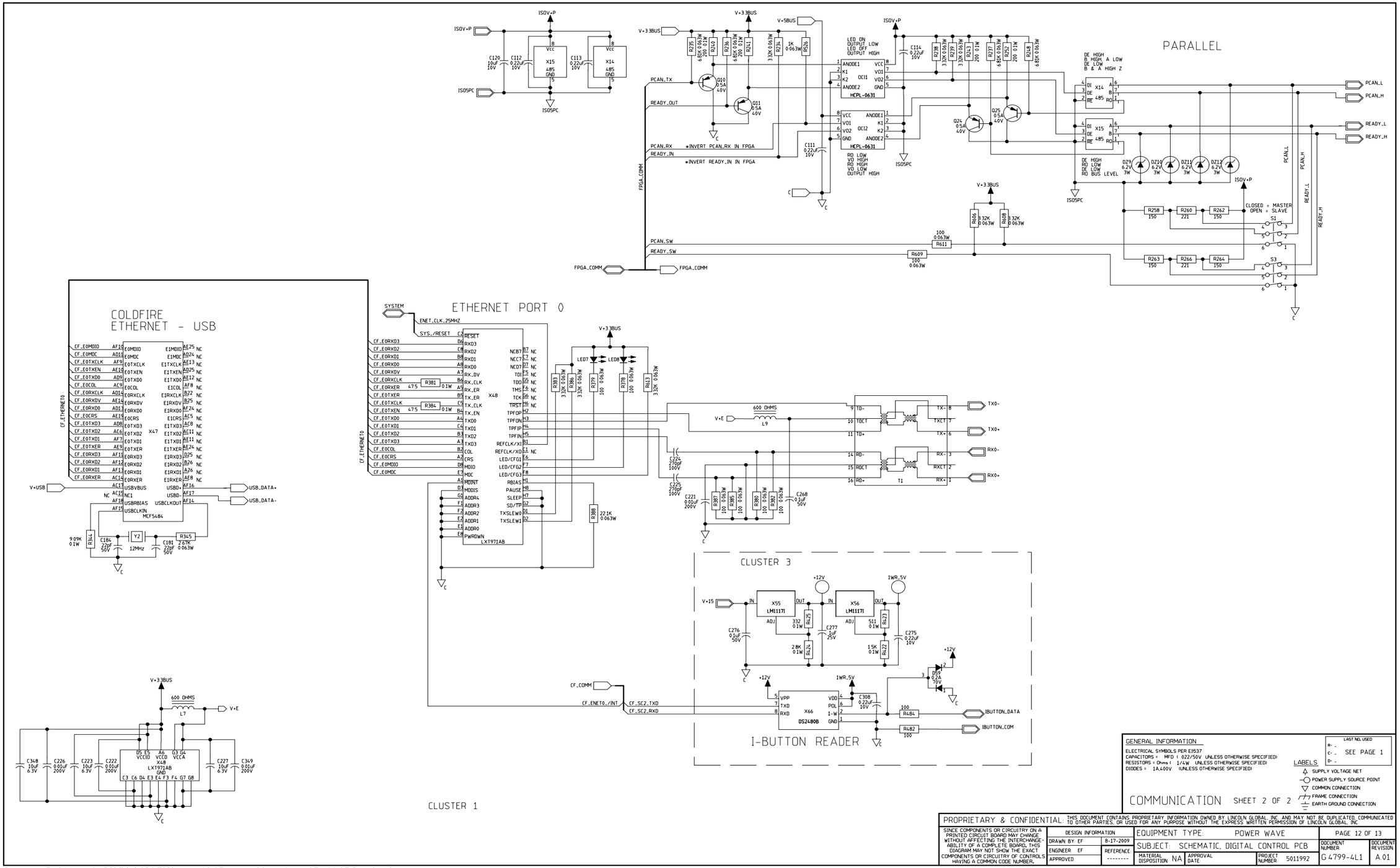


C:\Jobs\G4800-4L1\COMMUNICATION.sbk(11,17) Mon Aug 17 11:25:34 2009

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

SCHEMATIC - DIGITAL CONTROL PC BOARD (G4799 PG 12)



C:\Jobs\G4800-4L1\COMMUNICATION.sbk(12,17) Mon Aug 17 11:25:34 2009

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A,400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED
R- .
C- . SEE PAGE 1
D- .

LABELS
SUPPLY VOLTAGE NET
POWER SUPPLY SOURCE POINT
COMMON CONNECTION
FRAME CONNECTION
EARTH GROUND CONNECTION

COMMUNICATION SHEET 2 OF 2

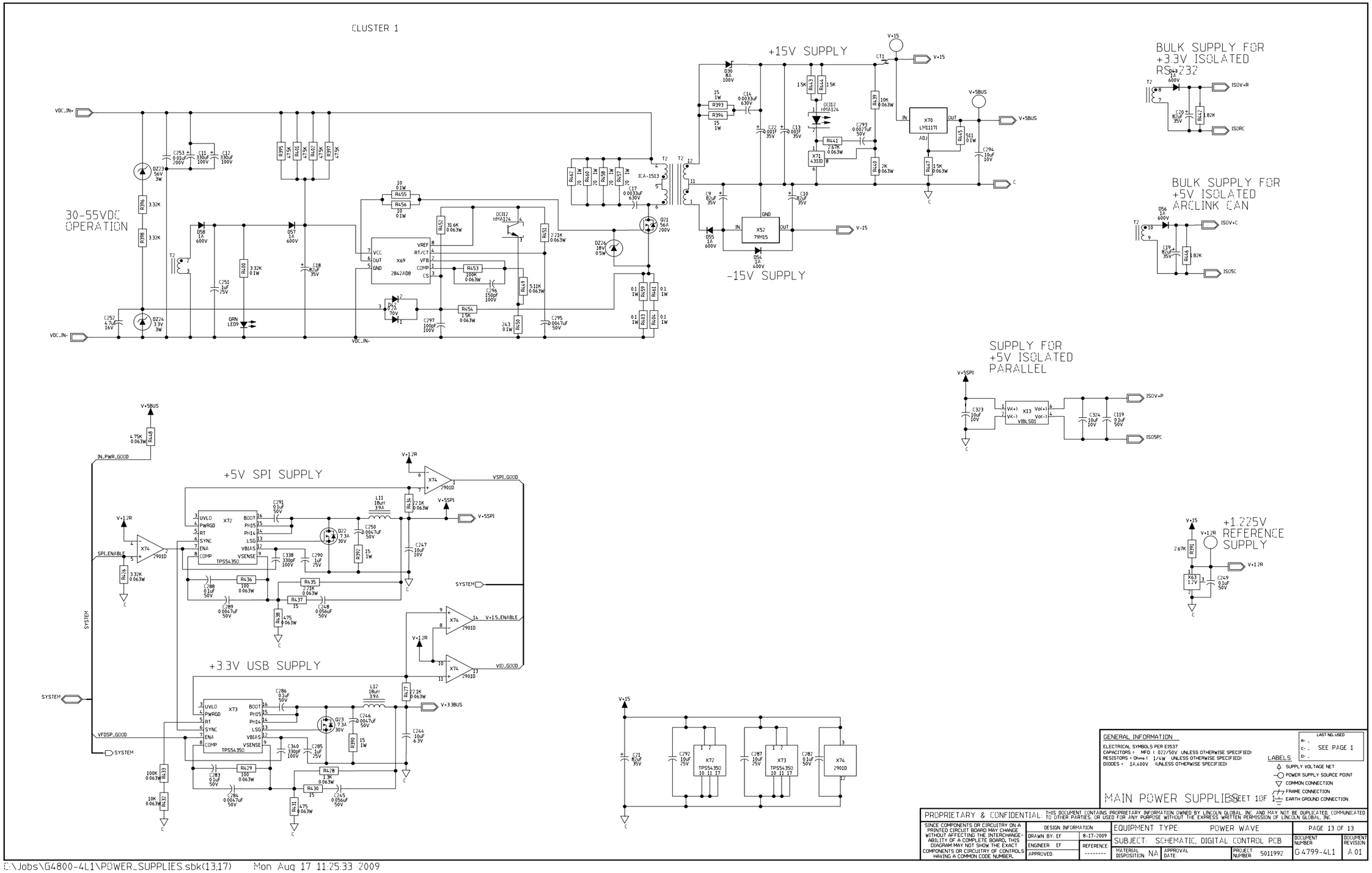
PROPRIETARY & CONFIDENTIAL: THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OWNED BY LINCOLN GLOBAL INC. AND MAY NOT BE DUPLICATED, COMMUNICATED OR USED IN WHOLE OR IN PART FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF LINCOLN GLOBAL, INC.

SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

DESIGN INFORMATION		EQUIPMENT TYPE: POWER WAVE	PAGE 12 OF 13
DRAWN BY: EF	8-17-2009	SUBJECT: SCHEMATIC, DIGITAL CONTROL PCB	DOCUMENT NUMBER: G4799-4L1 / DOCUMENT REVISION: A.01
ENGINEER: EF	REFERENCE		
APPROVED:	--------	MATERIAL DISPOSITION: NA / APPROVAL DATE: / PROJECT NUMBER: 5011992	

Return to Section TOC
Return to Master TOC

SCHEMATIC - DIGITAL CONTROL PC BOARD (G4799 PG 13)

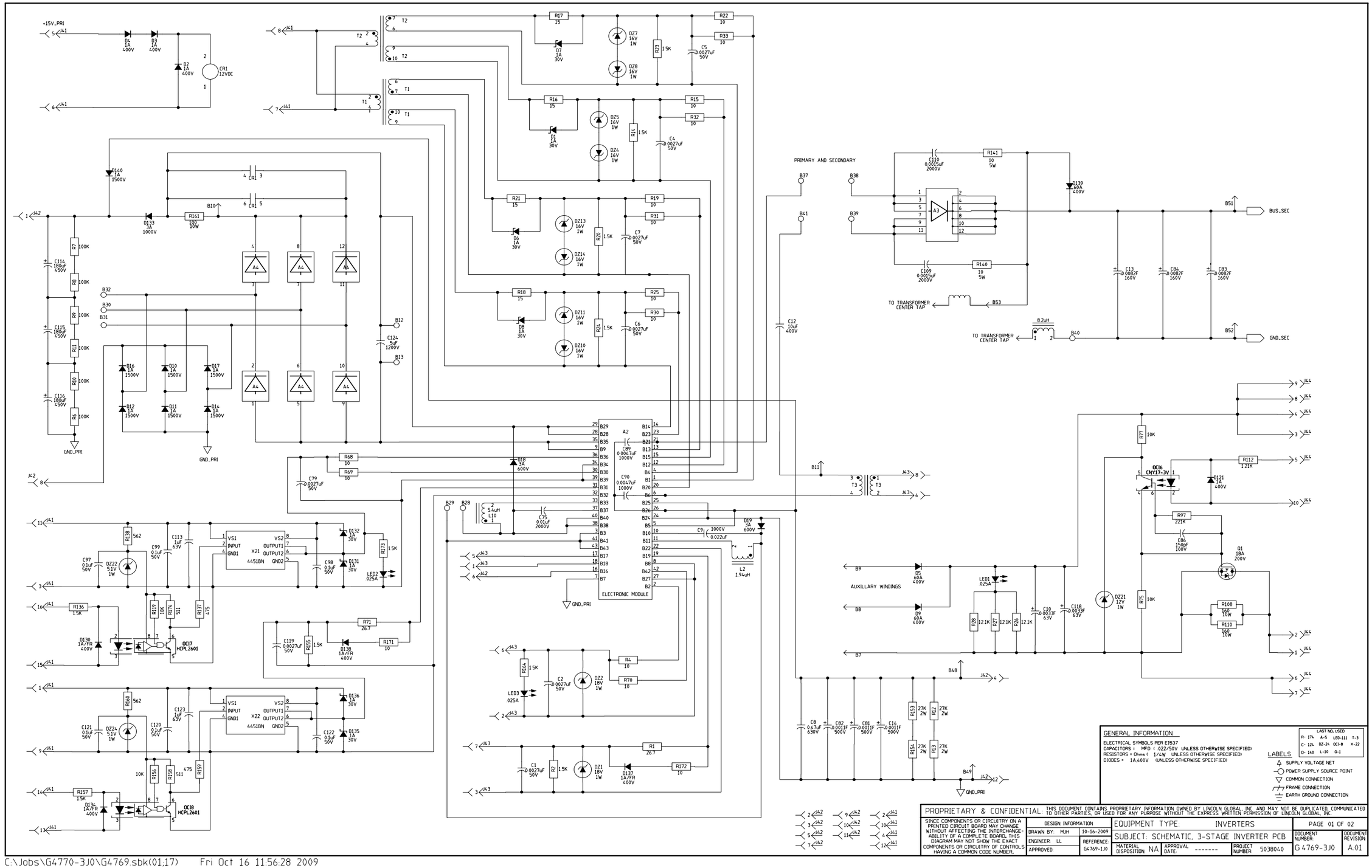


C:\Jobs\G4800-4L1\POWER_SUPPLIES.sbk(13,17) Mon Aug 17 11:25:33 2009

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

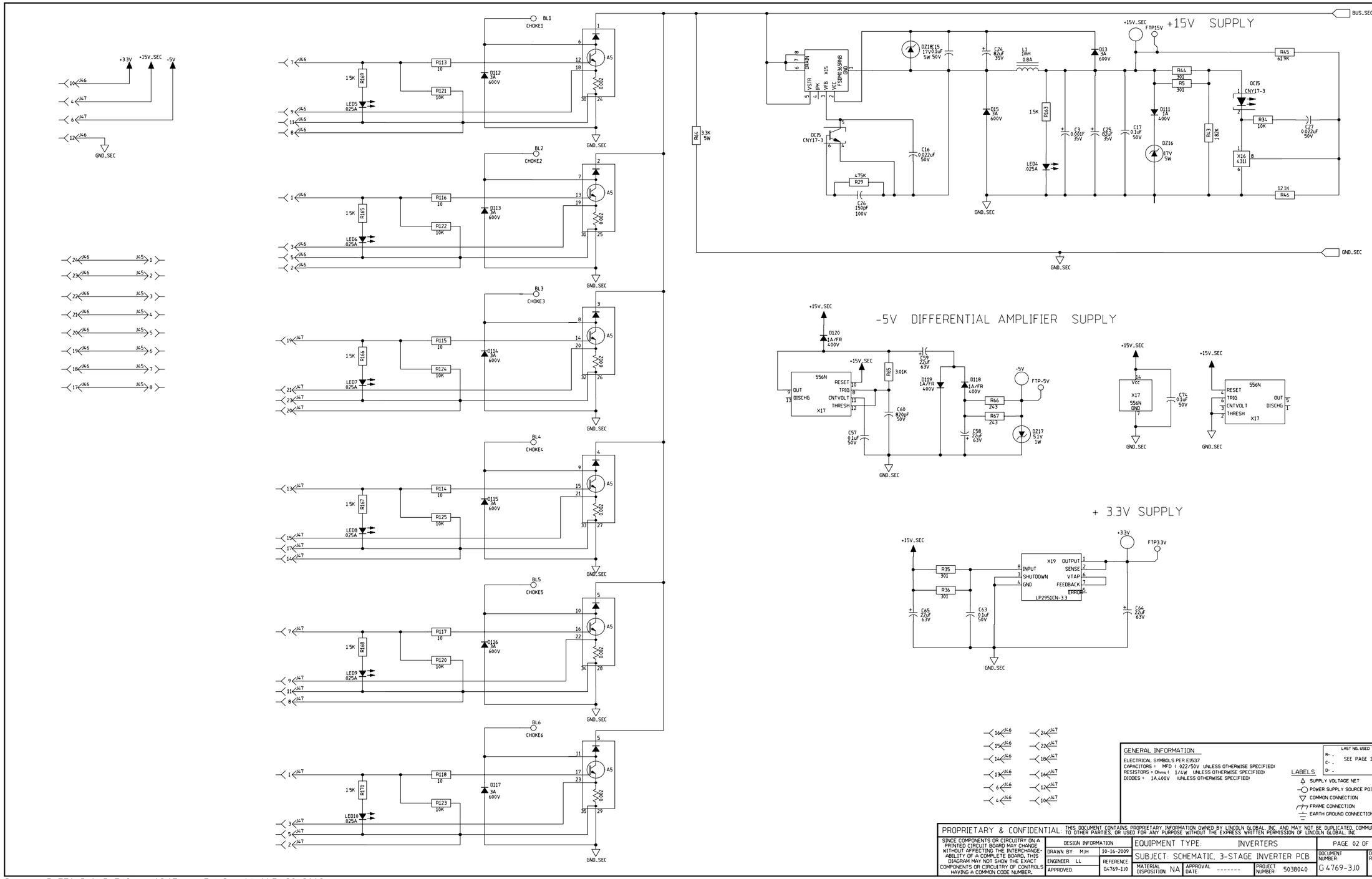
SCHEMATIC - 3 STAGE INVERTER PC BOARD (G4769 PG 1)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

SCHEMATIC - 3 STAGE INVERTER PC BOARD (G4769 PG 2)

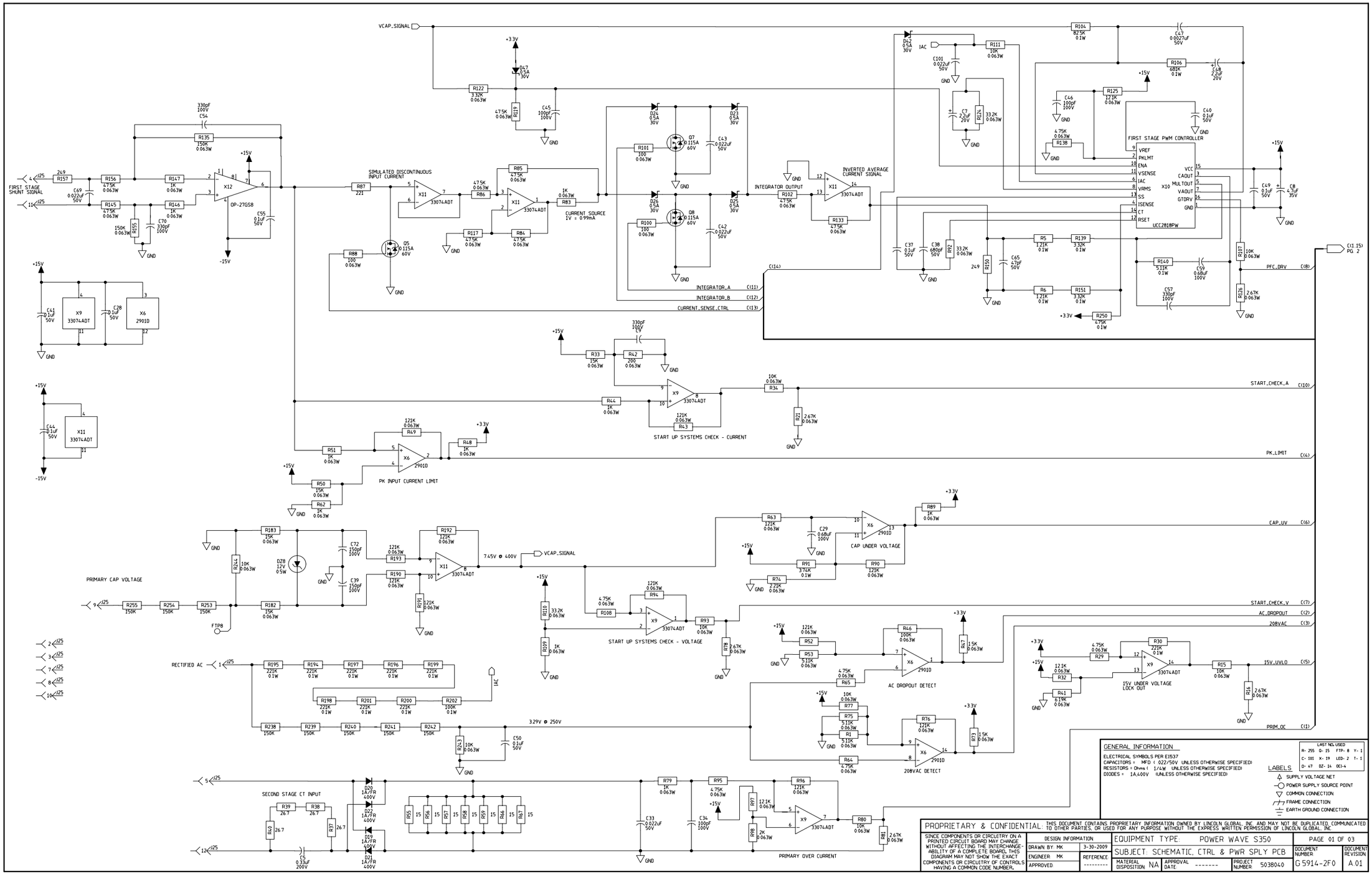


C:\Jobs\G4770-3J0\G4769.sbk(02;17) Fri Oct 16 11:56:28 2009

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

SCHEMATIC - 3 STAGE INVERTER PC BOARD (G5914 PG 1)

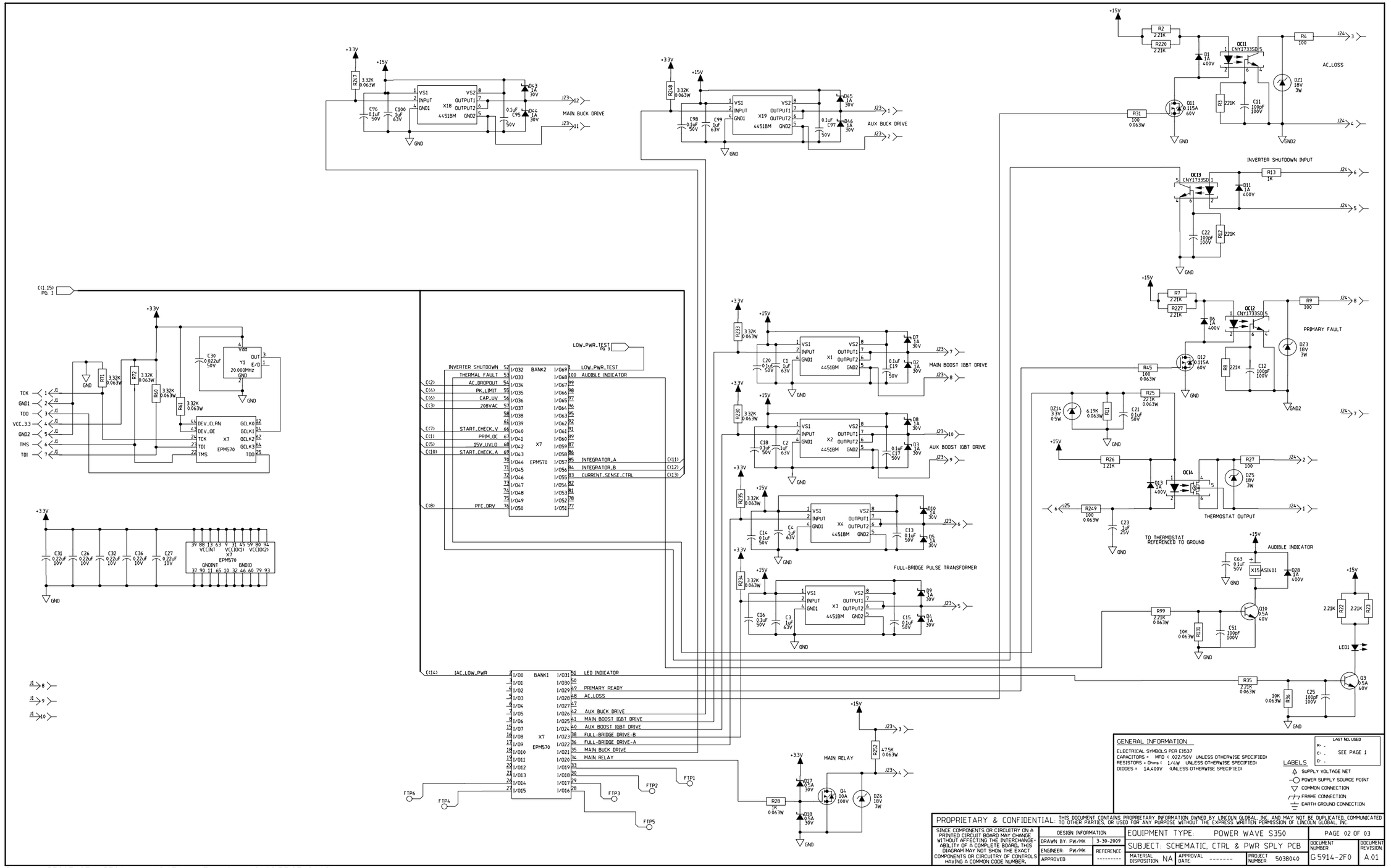


C:\Jobs\G5915-2F0\G5914.sbk(01,17) Thu Apr 02 12:57:24 2009

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

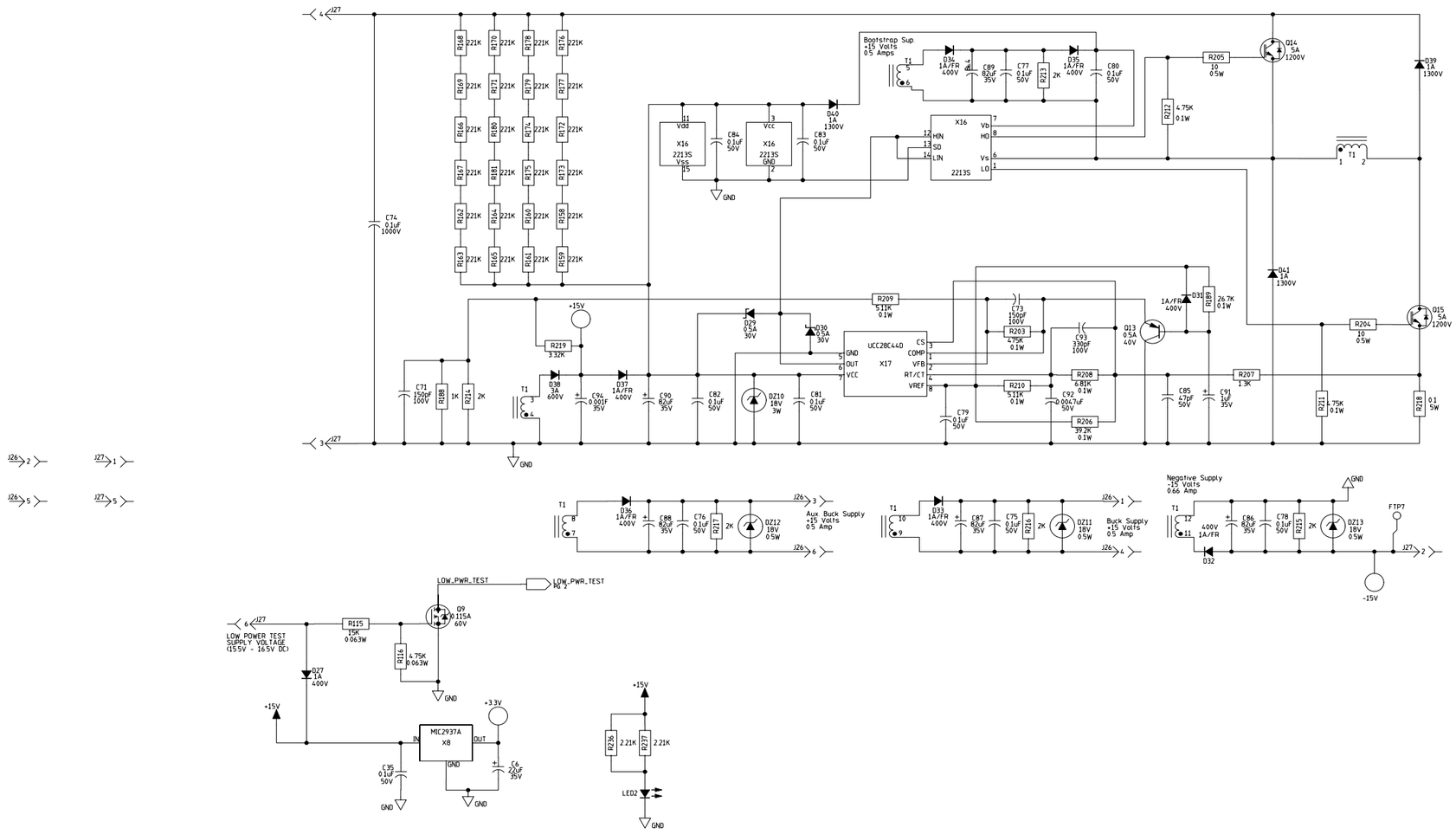
SCHEMATIC - 3 STAGE INVERTER PC BOARD (G5914 PG 2)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

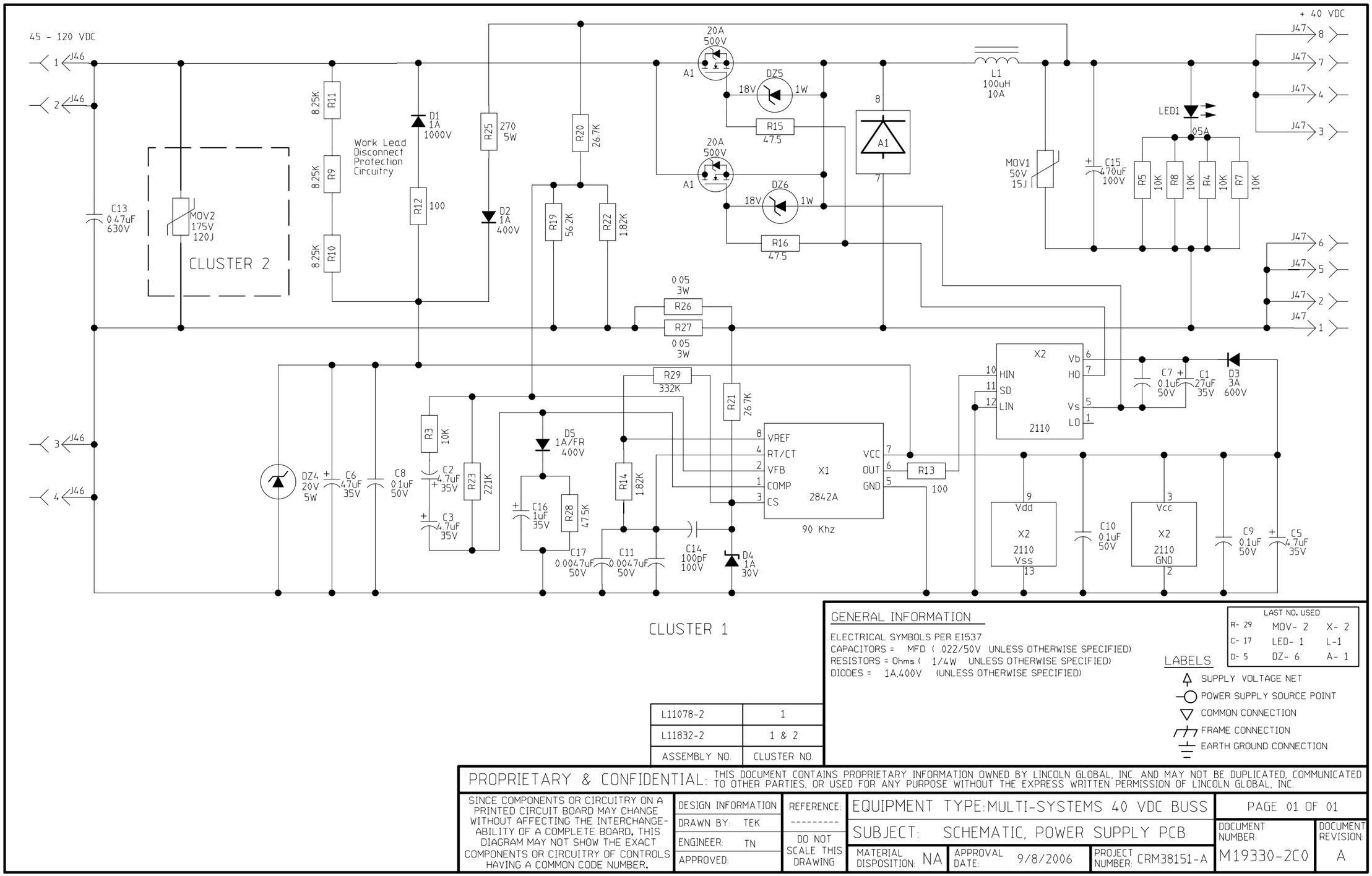
SCHEMATIC - 3 STAGE INVERTER PC BOARD (G5914 PG 3)



C:\Jobs\G5915-2F0\G5914.sbk(03,17) Thu Apr 02 12:57:25 2009

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - 40 VDC BUSS POWER SUPPLY PC BOARD (M19330)



CLUSTER 1

GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A,400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED		
R- 29	MOV- 2	X- 2
C- 17	LED- 1	L-1
D- 5	DZ- 6	A- 1

LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

L11078-2	1
L11832-2	1 & 2
ASSEMBLY NO.	CLUSTER NO.

PROPRIETARY & CONFIDENTIAL: THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OWNED BY LINCOLN GLOBAL, INC. AND MAY NOT BE DUPLICATED, COMMUNICATED TO OTHER PARTIES, OR USED FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF LINCOLN GLOBAL, INC.

SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGE-ABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

DESIGN INFORMATION	
DRAWN BY:	TEK
ENGINEER:	TN
APPROVED:	

REFERENCE: --------

DO NOT SCALE THIS DRAWING

EQUIPMENT TYPE: MULTI-SYSTEMS 40 VDC BUSS

SUBJECT: SCHEMATIC, POWER SUPPLY PCB

MATERIAL DISPOSITION: NA

APPROVAL DATE: 9/8/2006

PROJECT NUMBER: CRM38151-A

PAGE 01 OF 01

DOCUMENT NUMBER: M19330-2C0

DOCUMENT REVISION: A

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.